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# METALS and ALLOYS

## The Magazine of Metallurgical Engineering

**PRODUCTION • FABRICATION • TREATMENT • APPLICATION**

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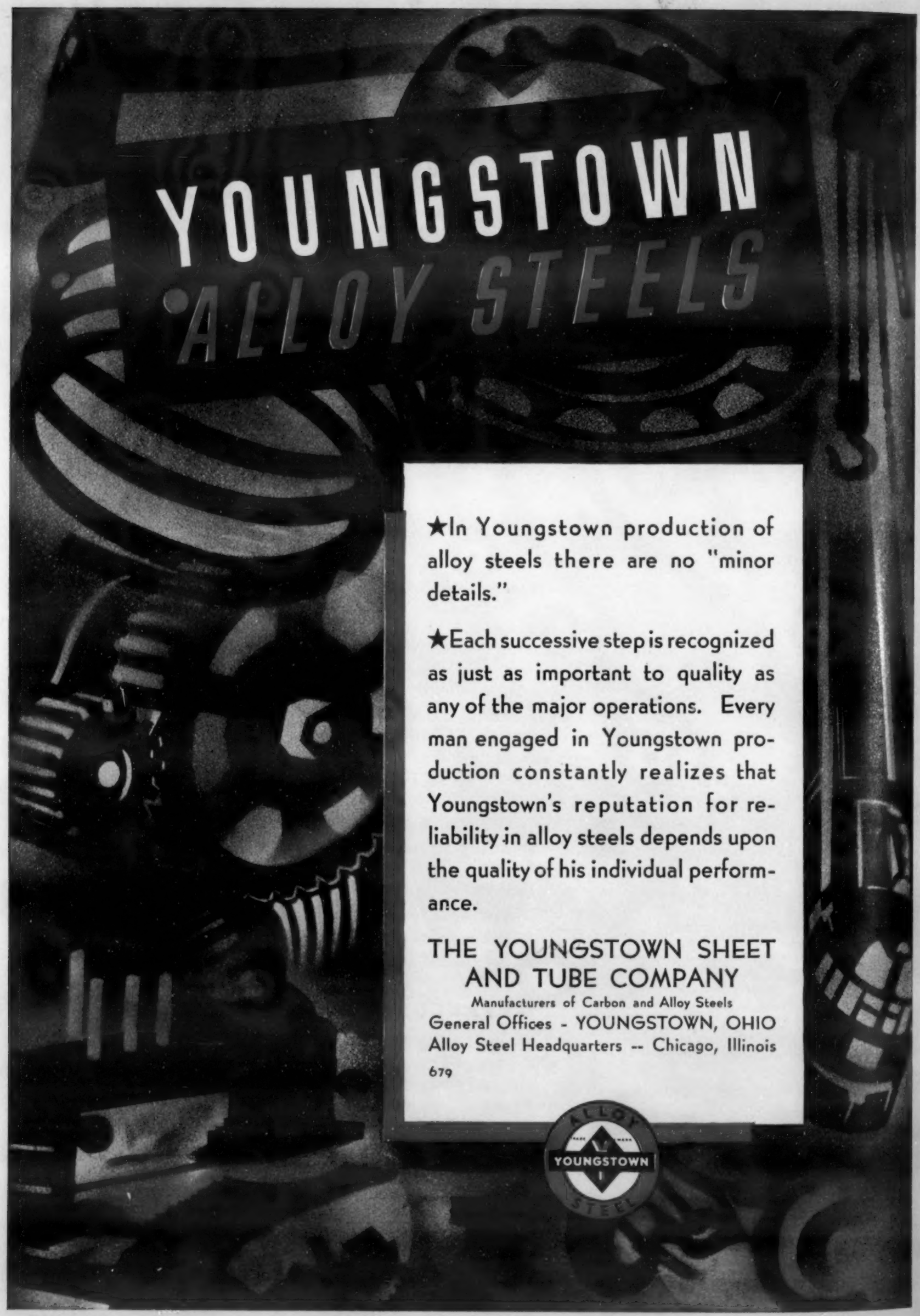
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# Highlights

**WRITTEN BY THE ABSTRACT SECTION EDITORS AND THE EDITORIAL STAFF**

*Do you want to know what metallurgical engineers are saying, the world over? Look in the Current Metallurgical Abstracts. Here are some of the points covered by authors whose articles are abstracted in this issue.*

---

### News on Flotation

Laboratory flotation of non-sulphide minerals is a common occurrence these days; a report of commercial success, however, is definitely news. In Greenland (page MA 266L2) froth flotation is used for the industrial purification of cryolite.—J.A.

### Flocculation and Flotation

The connection, if any, between flocculation and flotation has puzzled us for years. Fahrenwald and Newton (page MA 266L6) have investigated the problem with quartz in water. Their interesting conclusion is that there is not *necessarily* any relationship between the flocculation or dispersion of quartz in water, and its flotation. Notice the qualification. It is typical of flotation research where many an investigator has been made cautious by the treacherousness of generalization.—J.A.

### Special Subjects This Month

Rolls for one thing, and the absorption of $N_2$ by molten steel, respectively on (pages MA 272L4, L5 and L6, and MA 300R4) and on (pages MA 267L2 and L4 and MA 300R2) come in for special attention this month.—H.W.G.

### Synthetic Sand

Glažunov (page MA 267L6) discusses colloidal $Fe_2O_3$ as bond for addition to silica or other sand without natural bond.—H.W.G.

### High Strength Low Alloy Steels

According to Brennecke (page MA 284R6) German use of this class of steels has advanced so that there is a demand for special welding rods to produce welds of corresponding properties.—H.W.G.

### Liquid Polishing

The possibility of producing smooth bright surfaces, e.g., on metallographic specimens, without resorting to the tedious time-consuming process of polishing by hand is very intriguing. On certain metals such a result has been obtained by electrolysis, the specimen being made the anode in a suitable electrolyte. Copper, brass, lead, and tin have been successfully handled: the solution and the conditions of electrolysis must be varied to suit the metal to be treated (page MA 289L9).—H.S.R.

### Foreign Fissures

We've long been led to understand that foreign rails were free from fissures, but Metchersky (page MA 292R10) says that, when the Sperry detector car was used on foreign railways, fissures were found.—H.W.G.

### Machinability

Kästner (page MA 299L6) thinks that machinability depends on having an immiscible phase present in the liquid state, rather than a characteristic structure, generalizing from behavior of free-machining Al alloys. But how about the effect of temper carbon in malleable? Isn't it a matter of setting the stage for formation of short chips instead of anything more obscure?—H.W.G.

### Standardization

Instead of 5 different Pb-Sn-Sb alloys, tailor made for different type-casting problems, the Printing Office (page MA 299L8) finds that a single alloy will serve.—H.W.G.

### Lead Pipe

Italian workers (page MA 304R2) find that Pb with 3/4% Cd and 1/10% As is hot stuff for pipes.—H.W.G.

### The Skin Effect

Habermann (page MA 306L9) finds that Al for high-frequency conductors can be made more efficient by plating on a thin layer of Cu, but Ridpath (page MA 306R10) discusses the precautions necessary to avoid contact corrosion between Al and Cu conductors, so one might expect to have to dope out a way to avoid a similar trouble with the plated Al, unless the plater succeeded in getting a non-porous coating.—H.W.G.

### Shape Machine Flame Cutting

The extreme "jig-saw" flexibility of the oxyacetylene process permits the most complicated and irregular shapes and contours in rolled or forged steel to be flame cut with the same ease as straight-edge or circular pieces. The cutting torch does not actually engage or contact the work at any time during the cutting operation. Therefore, the cutting torch is entirely free-running with reference to the production of the cut. Only a nominal amount of power is required to advance the torch and its holder over the work. The heaviest cuts are made with the same negligible power consumption as cuts in the lighter gages.

Machines for this work are mostly electric motor driven. Some are fitted with tracing devices which are manually guided around the outline of a drawing or templet of the required shape. One or more torches are mounted on the machine so as to describe identically the same motion as the tracing device over the work. In this way each torch cuts exactly the shape traced.

Other machines are fitted with electric driven guide rollers, which automatically follow a templet of the required shape, simultaneously controlling the movement of the torch so as to flame cut the same shape. Magnetized rollers, which adhere to the steel templets as they advance automatically around the contour distinguish still other types of oxyacetylene shape cutting machines (page MA 284R7).—E.V.D.

### Welded Structures for Hydraulic Turbines

A remarkable modernization of hydraulic turbine design has recently taken place through substitution of welded structures for steel castings for many of the parts. The usual economies, savings in weight, increases in strength and higher efficiency obtainable by fabrication have resulted.

One company has recently fabricated some exceptionally large welded structures for hydraulic turbines for the Bonneville project on the Columbia River. As a matter of fact some of these fabricated units are the largest of their type ever built in the United States. The turbines containing these welded structures are larger than have ever been produced anywhere. Both steel castings and rolled steel were used in some of these fabricated structures, making them of a composite nature.

Welding of these huge structures naturally gave rise to many problems, among which the control of distortion was of major importance, as a high degree of accuracy was essential. Sound engineering and close adherence to proper procedures, however, provided successful solutions to all the difficulties encountered (page MA 284R7).—E.V.D.

### Won't Yield Point!

Welter and Bernhardt (page MA 292 L 6) can't seem to agree on whether tensile tests made by direct application of weights of increasing load are statistic or dynamic. The latter brands them as dynamic, while the former calls them static, and neither will yield a point in ascribing yield point irregularities.—F.P.P.

### Graphite Size

Norbury and Morgan (page MA 270 R 3) present evidence indicating that the control during melting of the size of graphite in gray cast iron is a ticklish, yet entirely feasible procedure, for although Ti tends to refine the graphite size, Si CaSi and Al coarsen it—all when the iron was melted under oxidizing conditions.—F.P.P.

### Steel Electrodes for Arc Welding

Notvest (page MA 286 R 1) makes a complete study of the metallurgical characteristics of drawn wire for electrodes, as well as the arc reactions, slag formation, experience with coatings and final results. In fact his paper was so good it won the Wire Association Award.—F.P.P.

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# EDITORIAL

## Safety Pins

We happened to re-read Kettering's comment on the hypothetical case of the automobile kept under a bell jar for ten years, just as good as it ever was, but for which no one would even bid at an auction because it was outmoded by later and better models. This set us to thinking whether we have any manufactured articles that have not been outmoded and which we could not replace by more satisfactory ones.

There are some things that are entirely satisfactory, including a Rubberset shaving brush we've used over 25 years that is still tight and though worn down a bit, still serves its purpose; a solid rocking chair that we've sat in evenings for the same period; and a felt hat we've worn camping for ten years that still sheds the rain. These things are valued for their functional characteristics which, once right, are always right.

Outside of variations in design of a purely decorative nature, the size and shape of spoons and forks seem well standardized though the materials are not necessarily fixed.

But the article of a metallurgical nature that takes the prize for resistance to obsolescence seems to us to be the safety pin. We venture to think that a dozen well-preserved safety pins made 50 years ago would be just as useful and valuable as those manufactured today. There are mighty few things of which that can be said, and those few are very simple.

There are a good many standard alloys but, as the years go on, these become modified to some degree, as small amounts of deoxidizing, degasifying or grain size control elements are shown to be useful, and as impurities within a certain range are shown to be harmful or harmless. There is almost no limit to the amount of study that can profitably be applied to an alloy, a metallurgical process or product, provided only that its use is great enough so that small savings can be multiplied by quantity operation.

The observation that anything that has been made from the same material or in the same way for ten years ought to be carefully examined for the possibility of improvement, seems to be a sound one; indeed the main question is whether this time interval isn't too long.—H. W. G.

## Open-Hearth and Blast Furnace Progress

The annual conference of the Open-Hearth Committee of the American Institute of Mining and Metallurgical Engineers this year at Birmingham was one of the most successful and profitable ever held. The absence of a long list of specially prepared papers and the predominance of free discussion, on or off the record, contribute decidedly to the value of these meetings. Using a system of roll call by the chairmen, carefully scheduled topics are often thoroughly discussed and information of great mutual advantage brought to the surface. The deliberations this year revealed the fact that no little progress is being made in many phases of open-hearth operations—in automatic control, insulation, furnace construction, mold practice, metallurgical and grain size control, furnace practice and other phases.

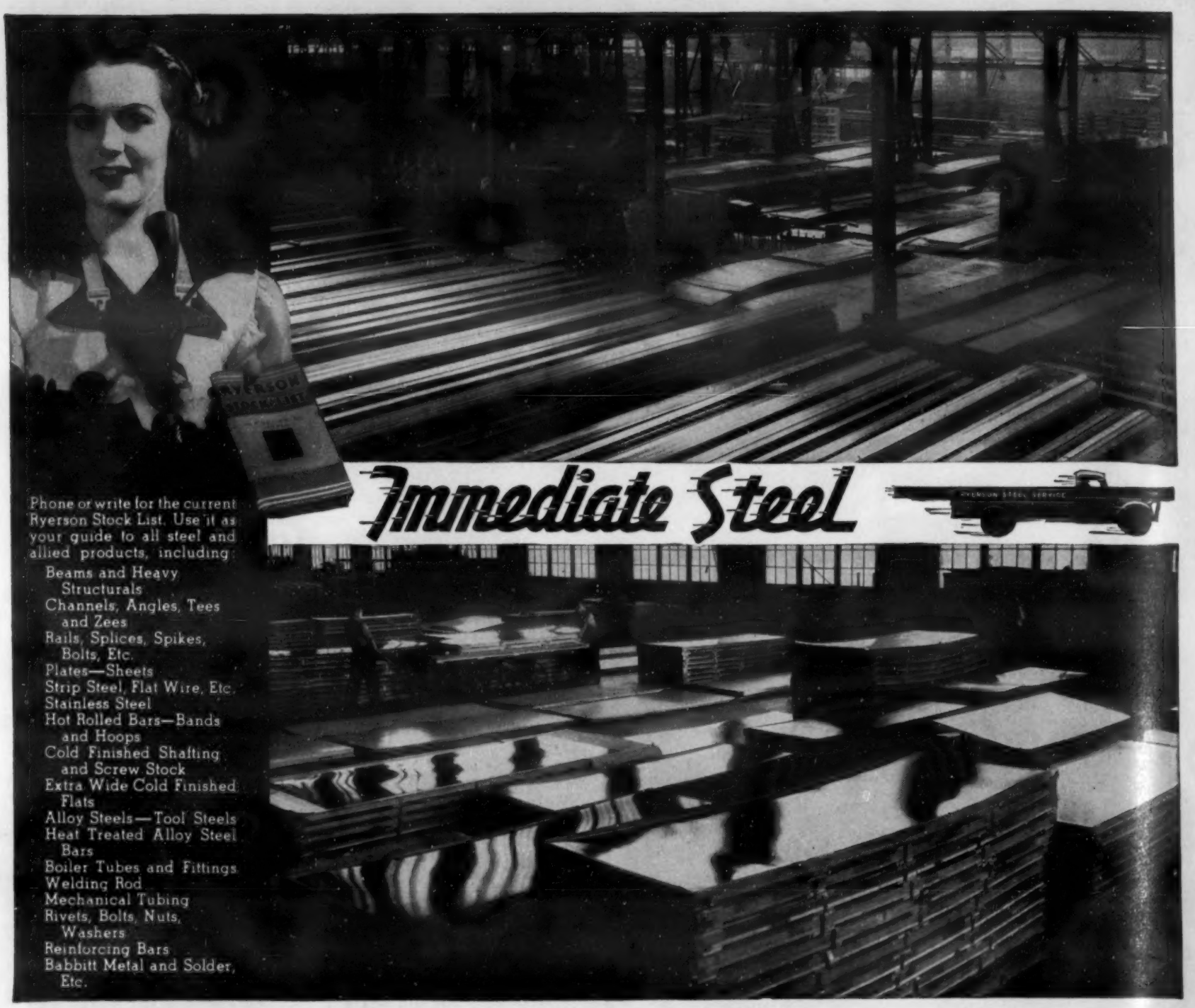
An unusual feature of this year's conference was the joint meeting of the Blast Furnace and Raw Materials Committee of the Institute. This was the first meeting of this character in ten years. It is evident that open-hearth and blast furnace men have many problems in common. Too frequently, blame for poor quality iron or steel is indiscriminately thrown back and forth when a rational comparison of the various factors involved would redound to the advantage of both and to the advancement of the profession. This year testimony was strong that the free interchange of opinions and mutual discussion of problems had been decidedly profitable. So much so that a movement is on foot to hold these conferences of the two groups each year, or at least more often than in recent years. It is to be hoped that, in the interest of the advancement of metallurgical knowledge, this will be realized.—E. F. C.

## Service Data on 18 and 8

There appear to be no published data on the actual service tests of the general run of stainless steels, particularly those used in architecture. This was pointedly brought to the attention of Committee A-10 on Iron-Chromium, Iron-Chromium-Nickel and Related Alloys at the recent A.S.T.M. group committee meetings in Chicago. A large prospective user of such material has been searching for actual data but none are collated.

In discussing the situation it was pointed out that there is plenty of source material—the Chrysler Building and the Empire State, as well as many smaller installations in other locations. It was contended, however, that such source material would be of little value unless its manufacturing history were known. It develops that, in the case of the two major installations of 18 and 8 cited, the history of the steel is available.

The result of these discussions was that a subcommittee will thoroughly investigate this matter. Many installations have been standing some five years and present an excellent opportunity for securing, through careful inspection and correlation with manufacturing history, information which is not only valuable in that it is of the long-time test brand but also very much needed. In the present situation steel producers seem unable to demonstrate to prospective customers just what these products will do. The report will be keenly looked forward to and will clear up, perhaps, some contradictory current opinions about the resistance of 18 and 8 to atmospheric corrosion.—E.F.C.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# CURRENT Metallurgical Abstracts

## A DIGEST OF THE IMPORTANT METALLURGICAL DEVELOPMENTS OF THE WORLD

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## CLASSIFICATIONS

### 1. ORE CONCENTRATION

*Crushing, Grinding & Plant Handling (1a), Gravity Concentration (1b), Flotation (1c), Magnetic Separation (1d), Amalgamation, Cyanidation & Leaching (1e).*

### 2. ORE REDUCTION

*Non-Ferrous (2a), Ferrous (2b).*

### 3. MELTING, REFINING AND CASTING

*Non-Ferrous (3a), Ferrous (3b).*

### 4. WORKING

*Rolling (4a), Forging & Extruding (4b), Cold Working, including Shearing, Punching Drawing & Stamping (4c), Machining (4d).*

### 5. HEAT TREATMENT

*Annealing (5a), Hardening, Quenching & Drawing (5b), Aging (5c), Malleableizing (5d), Carburizing (5e), Nitriding (5f).*

### 6. FURNACES, REFRACTORIES AND FUELS

### 7. JOINING

*Soldering & Brazing (7a), Welding & Cutting (7b), Riveting (7c).*

### 8. FINISHING

*Pickling (8a), Cleaning, including Sand Blasting (8b), Polishing & Grinding (8c), Electroplating (8d), Metallic Coatings other than Electroplating (8e), Non-Metallic Coatings (8f).*

### 9. TESTING

*Inspection & Defects, including X-Ray Inspection (9a), Physical & Mechanical Testing (9b), Fatigue Testing (9c), Magnetic Testing (9d), Spectrography (9e).*

### 10. METALLOGRAPHY

### 11. PROPERTIES OF METALS AND ALLOYS

*Non-Ferrous (11a), Ferrous (11b).*

### 12. EFFECT OF TEMPERATURE ON METALS AND ALLOYS

### 13. CORROSION AND WEAR

### 14. APPLICATION OF METALS AND ALLOYS

*Non-Ferrous (14a), Ferrous (14b).*

### 15. GENERAL

*Economic (15a), Historical (15b).*

# 1. ORE CONCENTRATION

JOHN ATTWOOD, SECTION EDITOR

**Cryolite Mining and Refining.** *Chemical Trade Journal and Chemical Engineer,* Vol. 99, Dec. 4, 1936, pages 471-472. From *Danish Foreign Office Journal,* Aug. 1936. Brief description of quarrying at Ivigtut, Greenland, and purification at plant of Oresunds Chemiske Fabriker, Copenhagen. Cryolite is crushed, sieved, and sorted. Pure pieces are removed and remainder again crushed, and then sieved and sorted by special appliances, mainly electromagnetic separators. Modification of froth flotation method is used for recovery of cryolite from fines and for final treatment. MS (1)

**Tybo Improves Its Metallurgy—Better Recovery Made from Ore of This Old District in Nevada.** J. B. HUTTL. *Engineering & Mining Journal,* Vol. 137, Dec. 1936, pages 619-620. The Tybo rich oxidized Ag ores have been mined intermittently since 1869. Gravity flow of ore to the crushing plant and through the flotation plant is conducted in a mill of 500 tons/day capacity. WHB (1)

## 1c. Flotation

**The Relations of Dressing Curves and Their Graphical Determination (Zusammenhänge der einzelnen Aufbereitungskurven und deren graphische Ermittlung)** G. TARJAN. *Royal Hungarian Palatine-Joseph University of Technical and Economic Sciences, Faculty of Mining, Metallurgy and Forestry of Sopron,* Vol. 8, 1936, pages 311-332. Summary in English. Formulas are developed for determination of metal content of concentrate, yield of metal and degree of separation and their application is illustrated. Ha (1c)

**The Problem of Measuring Settling Rates of Mineral Suspensions With Data on the Flotation of Quartz.** A. W. FAHRENWALD & JOSEPH NEWTON. *Engineering & Mining Journal,* Vol. 138, Jan. 1937, pages 23-28. An extensive study of the problem of measuring settling rates of mineral suspensions. The settling rate data for quartz, and data for quartz flotation lead to the following conclusions: (1) quartz is fully dispersed in distilled water; (2) an aqueous quartz suspension is sharply precipitated by small concentrations of caustic soda, partly redispersed with continued small additions of this reagent and then slowly but completely precipitated; (3) the sodium salts in which the anion as the radical of a weak acid are precipitants of quartz only when the acid of the salt is less ionized than silicic acid; (4) $Ca^{++}$ is a strong precipitant of quartz only in the presence of hydroxyls; (5) the effect of solute cations on the stability of aqueous quartz suspension is related to (a) the solubility of the hydrate of the cation, and (b) the solubility of the silicate of the cation; (6) pH predominates in surface reactions involved in aqueous quartz suspensions; (7) Na salts are not promoters of quartz flotation; (8) hydroxides of Ca and of Ba are precipitants of quartz in aqueous suspension and promoters of quartz flotation; (9) base metal nitrates of $Ca^{++}$, $Ba^{++}$, $Al^{+++}$, $Fe^{+++}$ $Zn^{++}$, $Cu^{++}$, and $Pb^{++}$ have widely different quartz flotation activating properties and (10) there is not necessarily any relationship between the state of a mineral (quartz) in water suspension and the floatability of the mineral. WHB (1c)

## 1e. Amalgamation, Cyanidation & Leaching

**Extraction of Copper from Roasted Concentrates by Sulphuric Acid Baking.** CARL FREDERICK FLOE. *American Institute Mining & Metallurgical Engineers, Technical Publication* No. 768, Feb. 1937, 16 pages. Results of laboratory work on a process for extraction of electrolytic Cu from flotation concentrate are given. The process consists in mixing roasted concentrate with a solution of $H_2SO_4$ and baking, first at 150 to 300° C. and finally at 600° C. The product is leached with water, which dissolves about 98% of the Cu and only from 6 to 10% of the Fe. Cu is recovered from the leach solution by electrolysis. The process can be made cyclic by using the $H_2SO_4$ regenerated during electrolysis for baking more concentrate. The Fe content of the solutions is controlled by the high temperature of the 2nd bake, which decomposes most of the Fe sulphates. Cu ferrite is also made soluble by this treatment. Au and Ag can be extracted from the leached concentrate with cyanide. JLG (1e)

# 2. ORE REDUCTION

A. H. EMERY, SECTION EDITOR

## 2a. Non-Ferrous

**Studies on the Treatment of Domestic Chrome Ores.** J. KOSTER. *Progress Reports—Metallurgical Division 13, Electrometallurgical Investigations. U. S. Bureau of Mines, Report of Investigations* No. 3322, Oct. 1936, pages 3-27. Domestic chrome ore can be reduced with anthracite to produce ferrochrome containing 8-10% C at 80% yield without slag retreating. Chrome ore was smelted with pyrite to yield a matte with a Cr/Fe ratio higher than that in the ore and a metal of lower Cr/Fe ratio. It is difficult to achieve good recoveries of high-ratio material. No great change can be made in the Cr/Fe ratio of ferrochrome by remelting with Cu to form a duplex system. Smelting chromite in the presence of Cu sulfide gives a matte having a splendid Cr/Fe ratio but containing considerable Cu. The Cr/Fe ratio in the Fe-Cr-Cu-S matte systems was studied in synthetic mixtures. Metallic Ca in great excess removes some of the C from high-C ferrochrome. Metallic Si removes some of the C, but the resultant alloy is high in Si. AHE (2a)

**Electrolysis of Manganese Solutions.** S. M. SHELTON. *Progress Reports—Metallurgical Division. 13. Electrometallurgical Investigations. U. S. Bureau of Mines, Report of Investigations* No. 3322, Oct. 1936, pages 29-37. Metallic Mn can be deposited readliy from $MnSO_4$ and $(NH_4)_2SO_4$ or $NH_4Cl$ solution provided the Mn concentration is more than 15 g./l. and the normal concentration ratio of $NH_4$ ion to Mn ion is 1 or greater. The use of a diaphragm seems to be necessary for continuous deposition. Addition of sulfite ion to the catholyte increases the purity of the deposit, improves the texture, and reduces the tendency to form nodular surfaces. The form of hydrated Mn oxides in the catholyte can be controlled by addition of sulfite ion. By continuous electrolysis Mn deposition was obtained at more than 50% current efficiency and with a power consumption of 4.1 kw. hr./lb. $MnCO_3$ can be precipitated from pregnant leach solutions with $Na_2CO_3$ or $(NH_4)_2CO_3$. AHE (2a)

**Influence of Current Density and the Distance Between Electrodes on Current Yield and Optimum Working Conditions of Aluminum Cells.** G. A. ABRAMOV. *Metallurg,* Vol. 11, Sept. 1936, pages 13-28. In Russian. Mathematical study of the problem. (2a)

**Separation of Antimony from Copper in Tetrahedrite-tennantite by Volatilizing (Ueber die Trennung des Antimons vom Kupfer in Fahlerzen durch Verflüchtigung)** H. LEHMANN. *Metall und Erz,* Vol. 33, July 1936, pages 353-360. The vapor pressures of $Sb_2S_3$ at 500° and 600° C. were much greater than the vapor pressures of $Sb_2S_3$ normally obtained in the thermal dissociation of tetrahedrite-tennantite ($Cu_3SbS_3$). Successful volatilization of Sb as $Sb_2O_3$ depends on preventing the formation of antimonates; antimonites on the other hand are easily decomposed thermally. Recommended practice is to flux with $SiO_2$ in weakly oxidizing gas. FPP (2a)

**Open Schedules for Gold and Silver Ores and Concentrates at Western Custom Smelters.** E. D. GARDNER & PAUL T. ALLSMAN. *U. S. Bureau of Mines, Information Circular* No. 6926, Dec. 1936, 25 pages. The effect of impurities in Pb and Cu smelting is discussed. Schedules of charges are given with examples of calculations. AHE (2a)

## 2b. Ferrous

**Application of Measuring Instruments in the Operation of Blast Furnaces (Anwendung des Messwesens auf die Betriebsführung des Hochofens)** S. HEINRICHS ET AL. *Stahl und Eisen,* Vol. 56, July 16, 1936, pages 809-815. A committee report giving a review of recent progress particularly of temperature measurements and gas analyses. Se (2b)

**Development of Mud Guns for Blast Furnace Tap Holes (Entwicklung der Stichloch-Stopfmaschinen)** W. ROHDE. *Stahl und Eisen,* Vol. 56, Oct. 29, 1936, pages 1297-1301. Several new types that overcome earlier difficulties are illustrated. SE (2b)

# 3. MELTING, REFINING AND CASTING

G. L. CRAIG, SECTION EDITOR

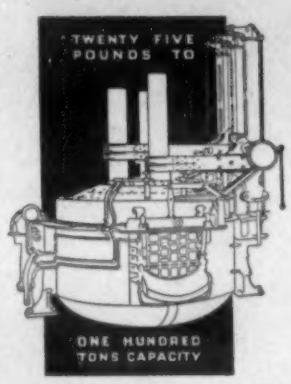
**Influence of Composition of Metal, Slag and Gaseous Phase on Nitrogen Absorption by Liquid Steel.** A. A. SHATALIN. *Metallurg,* Vol. 11, July 1936, pages 55-64. In Russian. The major factor in N absorption in an arc furnace is the influence of the arc itself. Its nitriding action can be affected by selecting melting conditions, composition and amount of slag, atmosphere maintained in the furnace, etc. A series of heats made in a laboratory furnace indicated that increased C content reduces N absorption while Mn increases it. The influence of Si and Al present in the liquid metal was not clearly established. Larger amount of slag leads to a reduced N content. Coke added to the slag raises N content until 0.03% N is absorbed by the metal, after which further coke addition has no appreciable influence. Composition of slag has an effect on N absorption, but the question needs further study. See *Metals and Alloys,* Vol. 7, Nov. 1936, page MA 536R/1. (3)

**Distribution of Nitrogen Along the Surface of the Steel Bath.** P. YA. AGEEV. *Metallurg,* Vol. 11, July 1936, pages 65-71. In Russian. Taking samples under arcs, near arcs and at the banks of the furnace of five production heats showed that the highest N content was observed near the arcs and the lowest at the banks. Apparently arc produced nitrification while diffusion was not rapid enough to equalize its content throughout the metal. Boiling eliminates N proportionally to time allowed, under normal operating conditions, but the refining process increases the content of the gas, so that at tapping heats subjected to long and short boiling have the same N content. (3)

**The Effect of the Chemical Composition of Colloids in Foundry Sand (Über die Wirkung der chemischen Zusammensetzung von Kolloiden im Formsand)** A. GLAZUNOV. *Metallwirtschaft,* Vol. 16, Jan. 1, 1937, pages 13-19. The binding strength of foundry sand is chiefly affected by (1) moisture content, (2) amount and properties of binding material, (3) manner of working up sand, and (4) amount of ramming. In the reported research only (2) was considered, as the rest are fairly constant in foundry practice. Pure $SiO_2$ containing no colloids was used for foundry sand. Standard methods for making test specimens were employed, specimens being dried at 110° C. Silicic acid gel ($SiO_2$) did not increase the compression strength of foundry sand. Additions of colloidal $Fe_2O_3$ increased the strength of the test specimen to a maximum at 4% $Fe_2O_3$. Apparently the colloidal $Fe_2O_3$ reacts with the surface of the sand grains and for a certain grain size there exists an optimum amount of colloid just sufficient to cover the surface. Silicic acid gel added to sand containing colloidal $Fe_2O_3$ decreases the strengthening effect of the $Fe_2O_3$. Experiments were carried out with loam (41% $SiO_2$, 37% $Al_2O_3$, 3.2% $Fe_2O_3$) being used with colloidal $Fe_2O_3$ as a binder. The binding strength of the sand rises to a maximum with increasing amounts of binder. Colloidal silica gel affected the binding properties of the loam in a negative manner. Further research leads the author to conclude that binding power is largely a question of complex chemical reactions between the binding material and the surface of the sand, and that any physical process involved is of secondary importance. GA (3)

**Thermal Conditions in Different Layers of a Casting Mold Filled with Metal.** V. YA. ROMASHEVA. *Liteinoe Delo,* Vol. 7, No. 8-9, 1936, pages 32-35. In Russian. Assuming the surface of contact between the metal and sand is flat, that there is no temperature difference between the surface of sand and the metal, that the temperature of the source of heat is the same and that the properties of substances are not affected by heat, a formula was developed mathematically to represent heat distribution in the layers of molds located at different distances from the metal. A detailed account of experimental casting is given. Accurate temperature measurements in different locations furnished a series of curves illustrating thermal conditions of molds as a function of time and the distance from the metal. In the light of them the theoretical formula proposed has only a limited application. Only comparatively thin layers of sand adjoining the metal are heated sufficiently high to affect the molding properties of the mixture. (3)

**Is Porosity in Die Casting Inevitable?** E. E. EHRENBURG. *Liteinoe Delo,* Vol. 7, No. 8-9, 1936, pages 18-21. Discussion of factors leading to porous die castings. (3)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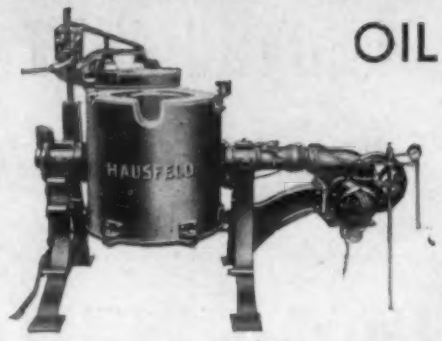


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**Present Position of Molding Sand Tests in Great Britain.** N. D. RIDSDALE. *Sands, Clays & Minerals,* Vol. 3, Nov. 1936, pages 65-66. Kinds of tests required and methods for determining moisture, permeability, green bond strength, hardness and compression strength are briefly described. Ha (3)

**Changes in Metal and Slag Composition in Ladles During Teeming.** I. BRAININ. *Metallurg,* Vol. 11, July 1936, pages 41-46. In Russian. Twelve heats of steel were investigated by analyzing slag and metal in the furnace and in the ladle. In open and rimming steels C and Mn content drops slightly, in killed it remains constant, though a slight increase of Si and P are observed. (3)

**Use of Ferro-alloys in the Foundry (L'Emploi des Ferro-alliages en Fonderie)** *Journal du Four Electrique,* Vol. 45, July 1936, pages 231-235. General. JDG (3)

**Melting Irons for Locomotive Cylinders.** A. A. SVARIK. *Liteinoe Delo,* Vol. 7, No. 6, 1936, pages 41-43. In Russian. Operating practice. (3)

**Casting Steel Gearing With Milled Teeth.** E. A. SINELNIKOV. *Liteinoe Delo,* Vol. 7, No. 6, 1936, pages 43-46. In Russian. Details of molding and gating practice for medium size gears. (3)

**Liquation Around Blow Holes in Rails.** P. C. NIKOLAEV. *Metallurg,* Vol. 11, Oct. 1936, pages 42-47. In Russian. It is suggested that liquation of brittle substances, such as phosphides, around blow holes might result in an effect similar to notch action. About 50 rails containing 0.5% C and 0.7% Mn were investigated both by micro and macro etching. The presence of pronounced segregations caused by liquation was established not only in the central zone of rails but all over their cross section. Their influence on fractures was not demonstrated. (3)

**Foundry Organization (L'Organisation a la Fonderie des Chemins de fer P.O.-MIDI, à Saint-Pierre-des-Corps)** AUDO. *Bulletin de l'Association Technique de Fonderie,* Vol. 10, July 1936, pages 247-268. Account in minute detail of plans, arrangement, organization, and management of a foundry. WHS (3)

**Tin in Fused Slags (Ueber Zinn in Schlacken-Schmelzflüssen)** B. KEYSSELITZ & E. J. KOHLMEYER. *Metall und Erz,* Vol. 33, Aug. 1936, pages 401-413. Intensive investigation of the
1 constitution of tin slags described. Synthetic melts containing SnO, FeO and $SiO_2$ were prepared, and phase equilibria studied over the whole ternary range. The synthetic slags were compared with some slags obtained in commercial operation. FPP (3)

— **Runners and Risers on Small Steel Multiple Castings.** H. T. LANGLEY. *Foundry Trade Journal,* Vol. 55, Oct. 29, 1936, pages 329-331. Paper read before the Birmingham, Coventry and West Midlands of the Institute of British Foundrymen. Feeding difficulties, overcoming fluid contraction, solid contraction, the time
2 factor are discussed. There is only about 100° C. difference between really hot and cold metal, and all metal has to be poured when ready. Illustrated with several photographs. AIK (3)

— **The Application of Science to the Control of Foundry Sands.** H. H. SHEPHERD. *Foundry Trade Journal,* Vol. 55, Oct. 29, 1936, pages 333-337. Author's modification of Smith's vibratory or bottle test, moisture determination, mechanical analysis, core sands,
3 coal dust, synthetic sand mixtures, etc., are discussed and practical suggestions given. Amount of moisture should be kept as low as is consistent with the required bonding condition necessary to give good joint lines and smooth castings. Silt and associated troubles
— are more likely to come from coal dust than from possible breakdown of normal sand grains. AIK (3)

**Mechanisation of Foundry Operations.** E. LONGDEN. *Engineer,* Vol. 162, Dec. 11, 1936, pages 639-641. Illustrated article
4 describing mechanical handling facilities as observed in American and British foundries. LFM (3)

— **Welding Versus Casting.** MATTHEW RUSSELL. *Foundry Trade Journal,* Vol. 55, Nov. 5, 1936, pages 351-353. A paper read before the Scottish branch, Institute of British Foundrymen. Competitive relation of casting and welding, and methods of improving the position of the former discussed. See *Metals and Alloys,*
5 Vol. 3, Apr. 1932, page MA107. AIK (3)

## 3a. Non-Ferrous

— **Casting Technique in Compound Casting of Light Metal Pistons (Giesstechnik beim Verbundgiessen von Leichtmetallkolben)** G. GRESSENICH. *Automobiltechnische Zeitschrift,* Vol. 39, Oct.
6 10, 1936, page 482. Casting machine described that makes possible, by a movable part in the bottom of the mold, the use of different light alloy compositions for different sections of the piston. Ha (3a)

— **Heats of Formation of Nickel-silicon Alloys and Melts (Die Bildungswärmen der Nickel-Silizium-Legierungen und-Schmelzen)** W. OELSEN & H. O. VON SAMSON-HIMMELSTJERNA. *Mitteilungen aus dem Kaiser-Wilhelm-Institut für Eisenforschung, Düsseldorf,* Vol. 18, No. 9, 1936, pages 131-133. A method for
7 determining heats of formation of Ni-Si alloys directly at room temperature described. The heat of formation of $Ni_2Si$ is 11.2 Kg. cal./g. atom or 33.6 Kg. cal./g. mol. and that of NiSi is 10.3 Kg. cal./g. atom and 20.6 Kg. cal./g. mol. at room temperature. A
— table for the heat contents of Ni-Si melts is given for the liquid phase at 1600° C. 5 references. Ha (3a)

**The Development of a Deoxidizer for Melting of Copper and Copper Alloys (Die Entwicklung eines Deoxydationsmittels für Schmelzen von Kupfer und Kupferlegierungen)** WILLI CLAUS.
8 *Giesserei,* Vol. 23, Nov. 20, 1936, pages 617-619. The properties of P as an all-round satisfactory deoxidizer discussed. A powdered P-Cu mixture is described which has been developed for
— use as deoxidizer. Ha (3a)

**Fundamentals of Purification of the Melt in Simple Copper Alloys (Grundsatzliches über die Schmelzflussreinigung der einfachen Kupferlegierungen in den Metallgiessereien)** WILLI CLAUS.
9 *Metallwirtschaft,* Vol. 15, Sept. 11, 1936, pages 862-865. The common impurities are Al, Fe, Sb, $H_2$, oxides and sulphides. The metallic impurities enter primarily through scrap material and can
— be controlled best by proper selection of such additions. Elimination of H by good melting conditions and the use of P and Li is quite feasible, and oxides can be eliminated with P additions. GD (3a)

10 **Utilising Brass Slags.** C. C. DOWNIE. *Metallurgia,* Vol. 15, Nov. 1936, pages 27-28. Metal is recovered from slags by melting after addition of materials to lower melting point. The slag is then cast into building blocks. Other methods of treating slags are discussed. JLG (3a)

Ohio Ferro-Alloys Corporation
Canton, Ohio

**Deoxidation of Silver Alloys (Die Desoxydation von Silberlegierungen)** H. ROTERS. *Mitteilungen des Forschungsinstituts und Probieramts für Edelmetalle,* Vol. 10, Nov./Dec. 1936, pages 89-96. The injurious effect of O in commercial Ag alloys is usually prevented by addition of P-Cu; other elements besides P that could satisfactorily be used as deoxidizers were investigated. The requirements for a good deoxidizer are higher affinity for O than that of Cu, it must be quickly dissolved in and absorbed by the melt, must have a low melting point, the oxide formed in the melt must be insoluble in the latter and have a low sp. gravity so that it floats on the melt and should quickly slag or evaporate, and if added in excess should not exert an injurious effect on the properties of the alloy. Deoxidation tests with different elements and Ag alloys are described. Elements with high heat of formation of their oxides and melting points below 900° C. remove O from Ag melts almost entirely within 1 to 5 min. If the melting points lie above 1000° C. complete deoxidation takes place only after longer time. Elements with low heat of formation of their oxides leave considerable $Cu_2O$ in the melt and equilibrium between CuO-deoxidizer and deoxidizer oxide-Cu results. Such elements can not be recommended as deoxidizers. Ca, Mg, Li, Be, Al and Si removed O entirely between 1 and 5 min., Cd, after 5 min. removed only 31%, Zn 77%, Sn and B 79%, P 88%, Mn 91.5% Ha (3a)

**Pressure Die-Casting.** *Times [London] Trade & Engineering,* Vol. 39, Aug. 1936, page 32. Reviews recent developments in die-casting alloys, die design, casting-machines, and applications of die castings. MS (3a)

## 3b. Ferrous

C. H. HERTY, SECTION EDITOR

**Rimmed Steel Quality.** GEO. L. DANFORTH, JR. *Blast Furnace & Steel Plant,* Vol. 24, Sept. 1936, pages 781-782. Discusses making of rimmed steel. Recent development is addition of NaF to molten metal while being cast into mold. It is inexpensive; accelerates rimming action of steel; produces ingot having thicker skin and fewer blow-holes, with no detriment to physical properties of steel in finished form; eliminates necessity for short ingot; and improves greatly rimming quality of steel containing more than 0.10% C and 0.45% Mn. MS (3b)

**Castability of Cast Irons (La Coulabilité des Fontes)** R. BERGER. *La Fonderie Belge,* Vol. 3, Nov.-Dec. 1934, pages 146-161. Continuation of report on work of the Belgian Foundrymen's Association. See *Metals and Alloys,* Vol. 5, June 1934, page MA 253 L/1. Conclusions of the study are: (1) Castability test bar is a very useful means for the practical foundryman as well as for the scientific investigator. For the latter, it will allow determination of liquidus lines in complex equilibrium-diagrams and the detection of physico-chemical changes during cooling liquid metal or during solidification. (2) The following general law can be derived for cast Fe: eutectic mixtures possess the best castability and consequently are the most suitable to give perfect castings. C has the most powerful effect on castability. Then P, and finally Si. The higher the content of these 3 the better the castability. Mn has but little effect. (3) Abnormalities have been found concerning effect of Si content on castability of cast Fe depending on P and Mn contents. **Castability of Cast Irons. Measurement of Temperatures (La Coulabilité des Fontes. Mesure des Températures)** R. BERGER. *La Fonderie Belge,* Vol. 4, Jan.-Feb. 1935, pages 173-180. Note about conditions of experiments made by the Belgian Foundrymen's Association when studying castability of cast Fe. Conclusions of the present section are: Emissivity of non-oxidized metal is within the range 0.36-0.44. When the surface of metal is oxidized the actual conditions are absolutely unknown. To measure temperature of molten ferrous metals, in the best way following practice is advocated: (a) If the temperature of a metal stream is to be measured and if the temperature is lower than 1400° C. direct the pyrometer on the bright spots, which radiate like a black body. The best spot to be used is where the stream leaves the spout. When the temperatures are higher than 1400°C. direct the pyrometer on dull spots and correct the readings according to an emissivity of 0.4. (b) It is difficult to determine the temperature of the metal when it is in a ladle at a temperature lower than 1,400° C., because the bath is covered with an oxide layer the thickness of which increases progressively. The temperature of this layer is lower than the underlying metal. This error is added to that caused by unknown emissivity. In this case, it is advocated to skim the surface of the metal and to direct the pyrometer on bright spots just after skimming. (c) Above 1400°C., (actual temperature) i.e. 1300°C. apparent temperature, if the surface of metal is clean, measurements should be corrected according to an emissivity of 0.4. The correction is about 100°C. for temperatures of about 1350°C. FR (3b)

**The Firing of Open-hearth Furnaces in German Steelworks.** FRIEDRICH WESEMANN. *Iron & Steel Institute,* Sept. 1936, Advance Copy No. 5, 24 pages. Following the War, German metallurgical works extended the use of brown-coal-briquette gas, mixed gas, and pure coke-oven gas as open-hearth fuels. The utility of the various fuels may be expressed in terms of their combustion temperatures, their luminosity, and the input of heat to the furnace. With the aid of preheater gas and air these fuels are adequate provided the luminosity of the flame is sufficiently good. Brown-coal dust, crude tar, or tar oil may be added to increase luminosity. The output of different furnaces is discussed. 12 references. JLG (3b)

**Speeding Up Steel Refining.** B. A. ROGERS. *Mining and Metallurgy,* Vol. 17, Oct. 1936, pages 478-480. Includes references. Brief resume of early rapid methods of refining, and describes the more modern methods of mixing slag and steel in fluid state. Of the modern processes the Aston and Perrin are of primary importance. According to Perrin process all the P and Si may be eliminated from given quantity of metal in a few minutes. Does not give details of Aston process. VSP (3b)

**The Effect of Non-Metallic Inclusions on the Graphite Size of Grey Cast Iron.** A. L. NORBURY & E. MORGAN. *Iron & Steel Institute,* Advance Copy No. 12, Sept. 1936, 20 pages. *Iron & Coal Trades Rev.* Vol. 133, Oct. 2, 1936, page 576. *Engineer,* Vol. 162, Nov. 6, 1936, page 487. *Foundry Trade Journal,* Vol. 55, Oct. 8, 1936, pages 272-274; Oct. 15, pages 297,298. Describes experiments on ¼-lb. crucible melts and cupola melts to control graphite size. Dissolving 0.1 to 0.2% Ti in the small melts and then bubbling $CO_2$ through the melt completely refined the graphite. Bubbling $H_2$ through melts treated in this manner completely coarsened the graphite. The Ti content of pig irons was found to control graphite size when melted under oxidizing conditions. The theory is advanced that treatment with Ti followed by oxidation produces titanate inclusions that are liquid externally when the graphite crystallizes; the liquid inclusions do not inoculate the melt and supercooling occurs, which produces fine graphite. On the other hand, additions of Si, CaSi, and Al produce inoculating inclusions that cause coarse graphite to form. H reduces FeO in the liquid inclusions, thereby leaving solid inclusions of $TiO_2$. More difficulty was found in producing fine graphite in cupola metal, probably owing to the reducing conditions in the cupola. Appendix 1 describes some experiments on the effects of gases in cast Fe. Appendix 2 gives a few data on the freezing point of Fe-C-Si eutectic. JLG + Ha + LFM + AIK (3b)

**Which Nitrogen Compounds Should Be Considered as Present in Electric Steel Slags?** M. S. MAKSIMENKO. *Metallurg,* Vol. 11, Sept. 1936, pages 11-12. In Russian. Polemical. Refers to paper by N. Chuiko, Domez, No. 8, 1935. See *Metals and Alloys,* Vol. 7, June 1936, page MA 314 R/2. (3b)

**The Effect of Silicide, Phosphide, and Carbide Formation in Iron Melts on their Equilibria with Oxides (Die Auswirkung der Silizid-, Phosphid-, und Karbidbildung in Eisenschmelzen auf ihre Gleichgewichte mit Oxyden)** F. KOERBER & W. OELSEN. *Mitteilungen aus dem Kaiser-Wilhelm-Institut für Eisenforschung, Düsseldorf,* Vol. 18, No. 9, 1936, pages 109-130. Heats of formation of Fe-Si alloys were determined by a simple method for room temperature over the whole concentration range. The disturbance of metal-slag equilibrium in the system Fe-Mn-Si-O by formation of silicide, phosphide and carbide was investigated, and the results plotted separately for each element. Additions of P dislocate the equilibrium considerably at 1600° C. Additions of C shift the reactions of Fe and Mn with $SiO_2$ to the right, although the reduction of FeO by Mn is only slightly affected. The application of the results to practical steel-making, especially low temperature deoxidation, is indicated. 38 references. See *Metals and Alloys,* Vol. 5, Dec. 1934, page MA 558. Ha (3b)

**Phosphorus (in Gray Iron).** Sloss-Sheffield Steel & Iron Co., Birmingham, Ala., Oct. 1936, 19 pages, 6"x9". While this is "manufacturer's literature" written to emphasize the utility of high-P pig, it cites evidence from technical literature which puts it on a higher plane than pure propaganda. Rebecca Hall Smith writes a correlated abstract on "Six Years Progress in the Metallurgy of P in Cast Iron," Y. A. Dyer discusses P in foundry pig. Fluidity, strength and wear resistance are features as virtues of high-P irons. J. T. Mackenzie in a section, "carbon equivalent in gray iron control," points out that 1% P or 1% Si is equivalent to 0.3% C in respect to freezing point of cast iron. F. E. Fisher adds a "castings analysis guide," showing TC, Si, S, P, and Mn ranges to make sound castings for some 60 types of service. The P content suggested ranges from a minimum of 0.25% in glass molds to a maximum of 1.25% in rolls for sugar mills. HWG (3b)

**Charging Miguet Furnaces Melting Ferro-silicon.** YA. S. SCHEDROVITSKI. *Kachestvennaia Stal,* Vol. 4, No. 8-9, 1936. In Russian. Different methods of charging the furnaces are compared, but no definite recommendations given. (3b) 1

**Predetermination of the Coke Charge in Blast Furnace Operation (Beitrag zur Vorausbestimmung des Kokssatzes im Hochofenbetrieb)** E. COTEL & M. KIR. *Royal Hungarian Palatine-Joseph University of Technical and Economic Sciences, Faculty of Mining, Metallurgy and Forestry,* Vol. 8, 1936, pages 65-69. More exact method of calculating heat balance is described, using a chart developed by the authors. Ha (3b)

**Molding Water-Turbine Steel Castings.** JOHN H. EASTHAM. *Mechanical World & Engineering Record,* Vol. 99, May 15, 1936, pages 489-491. The great size of the castings for water-turbine parts, in particular the intricate runner, raises problems of distortion, shrinkage, alignment, and balance. The whole of the molding is accomplished by the use of an assemblage of cores. WH (3b) 2

**Malleable Cast Iron.** C. H. PLANT. *Iron & Coal Trades Review,* Vol. 133, Nov. 6, 1936, page 785. The extent of application of malleable Fe in industry is discussed and English conditions compared with those abroad. Latest practice uses much steel scrap in production; there seems to exist no general agreement among different foundries on the proper C content of malleable Fe. Furnaces giving best results and now widely used are the Brackelsburg, the Sesci and the Stein rotary furnace. The electric furnace is economically feasible only in the duplex and triplex processes of remelting; for direct melting it is too expensive. Ha (3b) 3 4

**Moulding a Large Crane Barrel with Spiral Rope Grooves.** F. OLDERSHAW. *Foundry Trade Journal,* Vol. 55, Sept. 3, 1936, pages 181-182. The making of a casting is described. The size of the drum is 5′ diam. over the grooves and 6′, 3″ long. AIK (3b) 5

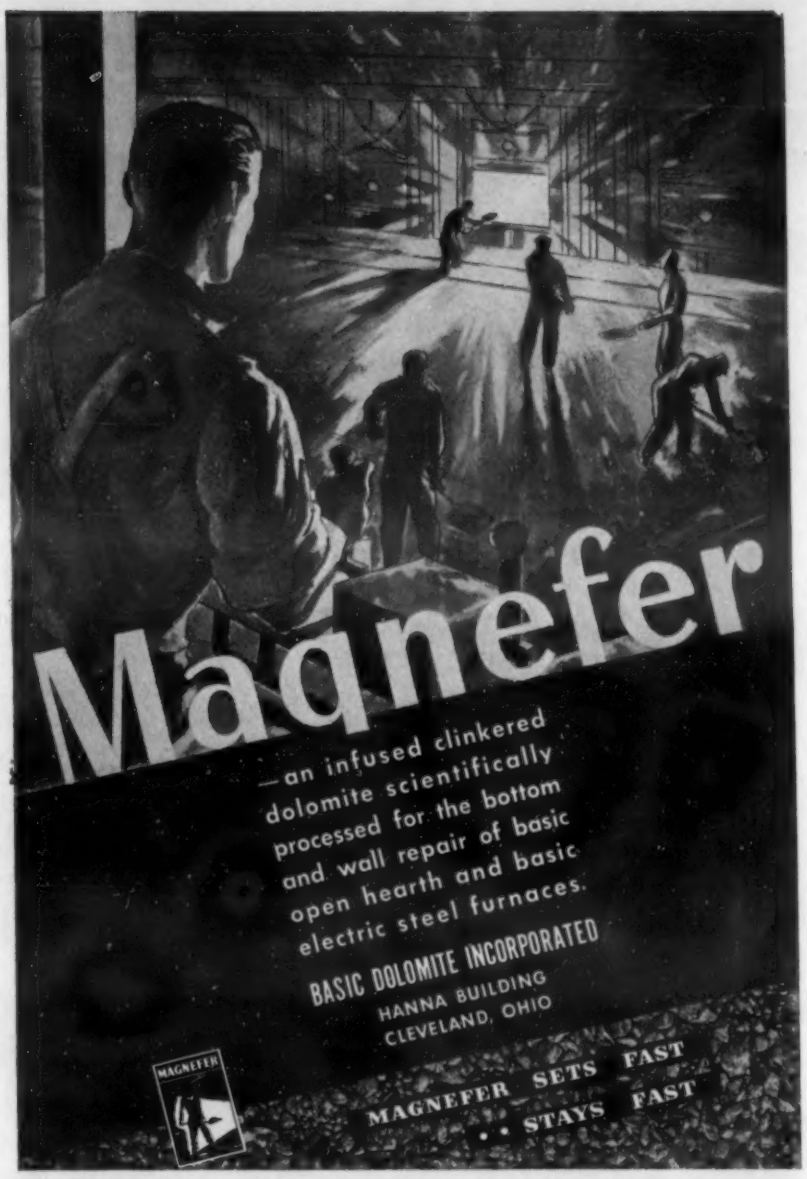
**Study of Factors Affecting Efficiency of Roberts Converters.** B. A. ANDREEV. *Liteinoe Delo,* Vol. 7, No. 8-9, 1936, pages 26-31. In Russian. A very detailed study of the factors involved in operation of baby Bessemer converters. (3b) 6

**Burning of Metal Constituents in Crucible Induction Furnace.** V. M. MALTSEV. *Kachestvennaia Stal,* Vol. 4, No. 8-9, 1936, pages 47-53. In Russian. A detailed study of the amount of charged constituents oxidized during melting in 1.4 ton induction furnaces under plant conditions. Total losses amounted to 0.80% of the charge for stainless steel and 1.33% for high speed steel. A comprehensive account of the behavior of individual elements and of energy distribution is given. (3b) 7

**Casting Segments for Subway Tubing in Green Sand.** S. A. DOMOV & V. M. AGEEV. *Liteinoe Delo,* Vol. 7, No. 8-9, 1936, pages 37-38. To speed production of 6 m. tubing dry sand was replaced by green sand. Details involved in the change are described minutely. Total foundry and machining defects were 8.2%. (3b) 8

**The Manufacture of Standard Flanged Castings.** J. H. LIST. *Mechanical World & Engineering Record,* Vol. 100, Oct. 9, 1936, pages 341-343. A number of examples are used to explain the routine of this type of work in the general foundry to give profitable operation. WH (3b) 9

**Casting High Chromium Iron.** P. E. ROJHKOV. *Liteinoe Delo,* Vol. 7, No. 8-9, 1936, pages 22-25. In Russian. Experimental production of 1.69% C, 37.6% Cr, 0.23% Mn, 0.82% Si cast Fe is described in detail. The metal could be cast easily in green and dry molds. It could be forged at about 800° C. and machined with the common tools; Brinell hardness was 217. The metal cannot be cut with an O-torch. Due to its narrow solidification range overheating in casting is recommended, though the fluidity of the metal is quite good. Its shrinkage is the same as that of high C steel, averaging 1.3-1.7%. The metal polishes well, has good heat resistance and some resistance to acids. (3b) 10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# 4. WORKING

**Nomogram for Calculations in Wire Drawing and Rolling.** M. I. ZLOTNIKOV. *Metallurg,* Vol. 11, Sept. 1936, pages 65-72 + 3 inserts. In Russian. Nomograms for rapid and accurate determination of the desired values were made by analytical and, to some extent, by graphic-analytical methods. Detailed calculations required to make them are given. Degree of deformation of round wires in drawing, roll pass dimensions needed in designing rolls according to square-oval-square system and biting angles in rolling are analysed and corresponding nomograms reproduced. (4)

**Progress in Seamless Tube Manufacture.** GILBERT EVANS. *Metallurgia,* Vol. 15, Dec. 1936, pages 45-47. Brief discussion. JLG (4)

## 4a. Rolling

S. EPSTEIN, SECTION EDITOR

**End Thrust of Cylindrical Rolls.** W. TRINKS. *Blast Furnace and Steel Plant,* Vol. 24, Dec. 1936, page 1089. When cylindrical rolls are aligned with their axes perfectly parallel, there can be no end thrust. If rolls are crossed, there is end thrust, which does not vary with degree of crossing, and is, theoretically, always the same. Practical experience shows that rolls almost in line operate with small end thrust, length of sheet being a factor. MS (4a)

**Direct Rolled Aluminum.** T. W. LIPPERT. *Iron Age,* Vol. 138, Oct. 15, 1936, pages 26-33, 46. Describes the direct rolling of Al by the Crown Cork & Seal Co. Other developments by the company are Al coated steel and a new alloy for the can industry. Al is rolled in what is known as the Hazlett direct-rolling mill from the liquid state in one operation, essentially a casting-rolling-extrusion process. Steel rolls used are coated with Al. The company may soon produce Al foil, and also contemplates direct rolling of steel, using the scrap accumulated at its canning machinery division. Gives details of procedure. VSP (4a)

**Diameter of the Rolls of Four-high Mills.** W. TRINKS. *Blast Furnace and Steel Plant,* Vol. 24, Oct. 1936, pages 873-875, 878. *Sheet Metal Ind.,* Vol. 10, Dec. 1936, pages 927-928. Rolls must be large enough to bite, withstand mill loads without breaking, withstand local swelling, and be sufficiently rigid against vertical or horizontal deflection. Complete details of diameter specification are given. MS + AWM (4a)

**Yield of 48-Inch Structural Mill Is Improved by Phototube Pyrometer.** A. J. STANDING. *Steel,* Vol. 99, Dec. 21, 1936, page 66. See *Metals and Alloys,* Vol. 8, Feb. 1937, page MA 74 L/5. MS (4a)

**Practicability of Artificial Plastic Bearings for Rolling Mills (Ueber die Wirtschaftlichkeit von Kunstharz-Pressstofflagern in Walzwerken)** O. ACHILLES. *Stahl und Eisen,* Vol. 56, Oct. 29, 1936, pages 1301-1304. Increased output, closer dimensions of the rolled product, lower first cost and lubrication cost, are reported for the artificial plastic bearings. SE (4a)

**Factors Affecting Roll Life in Four-high Mills.** W. TRINKS. *Blast Furnace and Steel Plant,* Vol. 24, Nov. 1936, pages 979-980. Wear, pitting, roughness, puffing up, spalling, and breaking are intensively analyzed as causes for removal of rolls from service. MS (4a)

**Strip Steel Production under British Conditions.** GEO. A. V. RUSSELL. *Blast Furnace and Steel Plant,* Vol. 24, Aug. 1936, page 718; Sept. 1936, page 824; Oct. 1936, page 922; Nov. 1936, page 1010; Dec. 1936, page 1107. From paper read before the Iron and Steel Institute. See *Metals and Alloys,* Vol. 7, Aug. 1936, page MA 401 L/3. MS (4a)

**Influence of Specific Pressure in Rolling on Friction Coefficient.** IG. M. PAVLOV & N. N. GET. *Metallurg,* Vol. 11, July 1936, pages 47-54. In Russian. In a series of experiments conducted on bimetal strips it was found that the coefficient of friction decreases with the increasing specific pressure. This relation holds valid for all metals tried in cold rolling, both for dry and lubricated strips. (4a)

2 **Rolling Round Rods by Hand (Das Walzen von Rundstahl aus freier Hand)** H. CRAMER. *Stahl und Eisen,* Vol. 56, Nov. 5, 1936, pages 1338-1342. Directions for avoiding sharp bends and other defects given. SE (4a)

— **Modern Equipment for Making "Armco" strip Steel.** CHARLES LONGENECKER. *Blast Furnace and Steel Plant,* Vol. 24, Dec. 1936, pages 1061, 1063-1066. Describes rolling-mills and accessory equipment at Middletown, Ohio, plant of American Rolling Mill Co. MS (4a)

3 **Calculating the Spreading in Rolling (Das Berechnen der Breitung beim Walzen)** F. RIEDEL. *Stahl und Eisen,* Vol. 56, Dec. 24, 1936, pages 1551-1556. The applicability of the spreading formulas previously developed by Spenlé and others is discussed. They apply for square sections, constant rolling temperature and speed, and for a given steel fairly closely. Where these factors vary, however, the spreading becomes difficult to calculate. SE (4a)

4 **Permissible Load Limits for Sheet and Strip Mills.** S. D. BRYLKIN. *Metallurg,* Vol. 11, July 1936, pages 27-34. In Russian. Factors involved are enumerated and briefly described. (4a)

— **New Cold Mill Rolls Wide Sheets.** *Steel,* Vol. 99, Dec. 21, 1935, pages 38-40. Describes rolling-mill and accessory equipment of cold reduction mill at East Works of American Rolling Mill Co., Middletown, O., for handling coiled strip with maximum width of 74 in. MS (4a)

5 **Temperature of Hot Steel in Motion Is Indicated Automatically.** *Steel,* Vol. 99, Nov. 23, 1936, page 62. Brief description of Optimatic system of measuring surface temperatures by an optical pyrometer. Consists of a sighting unit, power supply, and indicating and recording instruments. MS (4a)

— **New Continuous Mill in Detroit Makes Hot Strip Steel 90 Inches Wide.** *Steel,* Vol. 99, Oct. 5, 1936, pages 56-57. Brief illustrated description of mill of the Great Lakes Steel Corp. MS (4a)

6 **Tests of Burning Losses in Rolling Mill Furnaces (Versuche über den Abbrand in Walzwerksöfen)** F. WESEMANN & F. STRÄHUBER. *Stahl und Eisen,* Vol. 56, Oct. 22, 1936, pages 1279-1284. Water vapor in the fuel gas considerably increases scaling losses, particularly on heating above 1250° C. Infiltrated air may increase scaling losses as much as 1.5 to 2 times. Scaling losses may be from 1 to 2.5% by weight, depending on the section and being greater for heavier sections. Longer time at temperature also increases scaling losses. SE (4a)

— 7

## 4b. Forging & Extruding

A. W. DEMMLER, SECTION EDITOR

8 **Methods for Improving the Quality of Tire Metal (Procédés Permettant de Résoudre le Problème de l'Améliaration de la Qualité du Métal à Bandages)** MAURICE VITZENI. *Revue de Métallurgie,* Vol. 33, Nov. 1936, pages 665-670. Troubles connected with analysis were corrected by improving deoxidation practice. Segregation of pipe along the axis of ingots was effected by adjustment of ingot mold wall thickness. This shrinkage cavity is punched out in making a blank for the tire. JDG (4b)

9 **Rod and Tube Presses and their Dies (Metallstrang und Rohrpressen und ihre Werkzeuge)** S. PLANKENSTEINER. *Stahl und Eisen,* Vol. 56, Dec. 10, 1936, pages 1497-1504. Wire and tube mill practice is discussed and the following die and piercing point compositions given (in percentages):

10

| C | Mn | Si | Cr | W | V | Mo | Ni | Co |
|---|---|---|---|---|---|---|---|---|
| .35 | .25 | .25 | 3.0 | 9.0 | ... | ... | ... | ... |
| .25 | .20 | .20 | 2.5 | 10.0 | .20 | .20 | 1.5 | ... |
| .30 | .20 | .20 | 2.5 | 10.0 | .20 | .20 | ... | 2.5 |
| .25 | .50 | .70 | 1.3 | 4.0 | ... | ... | ... | ... |
| .25 | .25 | .25 | 3.0 | 9.0 | ... | ... | ... | ... |
| .35 | .35 | .30 | 1.5 | 1.0 | ... | ... | 4.5 | ... |
| .45 | .80 | 1.80 | ... | ... | ... | ... | 4.0 | ... |
| .35 | .50 | 1.00 | 1.3 | 4.25 | ... | .35 | ... | ... |
| .35 | .25 | .25 | 2.5 | 9.0 | ... | ... | ... | ... |
| .25 | .25 | .25 | 3.0 | 9.0 | ... | ... | ... | ... |
| .25 | .50 | .80 | 1.3 | 4.25 | ... | ... | ... | ... |

SE (4b)

**Investigations of Forging Phenomena (Untersuchungen über die Vorgänge beim Schmieden)** A. POMP & H. HOUBEN. *Mitteilungen aus dem Kaiser-Wilhelm-Institut für Eisenforschung,* Düsseldorf, Vol. 18, No. 7, 1936, pages 65-87. Review plus original research. Previous work done to determine the relation between deformability of a material and forging energy is reviewed, and new tests are described with Pb samples to determine the resistance to deformation. For all metals this resistance may be expressed by a general equation $k = c \times f^n$, where k is the resistance to deformation in kg./mm.$^2$, c is a constant dependent on material and f the deforming force in %, which is determined by $f = 1n\left(\frac{h_o}{h_1}\right)$ where $h_o$ and $h_1$ designate the height or length of the sample before and after deformation respectively. For Pb, and a ratio of 4:1 of radius of sample to its height, the equation is $4.51 \times f^{0.33}$. Effect of friction, velocity of deformation and losses of energy in the piece to be forged are discussed and shown in curves. Formulas for different materials and with a ratio 1:1 for diam. to height, as determined by the tests are:

| | |
|---|---|
| soft (Krupp) Fe | $k = 66.5 \times f^{0.28}$ |
| steel with 0.21% C | $k = 91.0 \times f^{0.19}$ |
| steel with 0.39% C | $k = 99.5 \times f^{0.154}$ |
| steel with 25% Ni | $k = 124 \times f^{0.33}$ |
| Al | $k = 20.2 \times f^{0.21}$ |
| Cu | $k = 43.5 \times f^{0.245}$ |

20 references. Ha (4b)

**Chevrolet Motor Company Operating New Forge Shop.** W. C. KERNAHAN. *Heat Treating and Forging,* Vol. 22, Dec. 1936, pages 601-605. Describes lay-out, equipment, and practice in forge shop and heat-treating department of plant at Muncie, Ind. MS (4b)

**A Compact New England Plant—The Storms Drop Forging Company.** W. C. KERNAHAN. *Heat Treating and Forging,* Vol. 22, Oct. 1936, pages 495-497. Describes various buildings and departments of plant at East Springfield, Mass. MS (4b)

**Developments in Modern Drop Forging.** R. E. W. HARRISON. *Heat Treating and Forging,* Vol. 22, Sept. 1936, pages 459-464, 478; Oct. 1936, pages 506-510. Paper presented before Detroit Chapter of American Society of Tool Engineers. Intended as continuation of paper read before American Society of Mechanical Engineers, Dec. 1935. Deals more specifically with features of good tooling. See *Metals and Alloys,* Vol. 8, Jan. 1937, page MA 12 R/8. MS (4b)

**Quantitative Analysis of Deformation Non-uniformity During Forging.** IG. M. PAVLOV, L. S. GELDERMAN & A. I. JHUKOVA. *Metallurg,* Vol. 11, July 1936, pages 17-20. In Russian. Authors claim the usual determination of grain size made at the intersection of the diagonals of some deformed object is wrong because it does not reflect the changes taking place in different portions of it. Non-uniformity of deformation decreases with the lowering of total deformation and with the increase of the temperature. (4b)

**Forging Monel Metal, Nickel and Inconel.** F. P. HUSTON. *Heat Treating and Forging,* Vol. 22, Oct. 1936, pages 499-505. Monel metal, Ni, and Inconel can be forged readily into almost any shape that can be forged in steel. Such forgings are stronger than those of bronze or of C steel that has not been heat treated subsequently. Forgings having unusually high physical properties can be made from K Monel, which can be hardened by heat treatment. Successful forging of these materials depends largely upon proper heating and avoidance of exposure of hot metal to S atmospheres or other sources of S. Complete details of operation, including fuels, temperatures, preheat time, die materials and physical properties of forgings are given. MS (4b)

## 4c. Cold Working — Shearing, Punching, Drawing & Stamping

**X-ray Study of Cold Deformation on the Surface.** S. P. VOSKRESENSKI & E. S. TOVPENETS. *Metallurg,* Vol. 11, Sept. 1936, pages 59-64. In Russian. Cold deformation produced by drawing a sizing mandrel through tubes and exploding a charge of powder inside of them was studied. Preston method was used and formation of twins used as the criterion for cold deformation. Deformation produced by mandrel is greater than that caused by explosion. The combined effect of the two is the same as by mandrel alone. Depth of cold deformation does not exceed one mm. in both cases and its distribution radially is a linear function. (4c)

**Rolling and Stamping Silumin Type Alloys with up to 2% Iron.** V. O. HAGEN-TORN & N. N. IVANOV-SKOBLIKOV. *Metallurg,* Vol. 11, Sept. 1936, pages 73-78. In Russian. Large quantities of Silumin made in Russian plants contain up to 1% Fe as accidental impurity. In order to establish the suitability of the alloy for industrial purposes a series of rolling and stamping operations on samples containing up to 2.07% Fe was conducted. Alloys investigated all contained 6-8% Si; and some contained in addition 0.4% Mg. Their Fe content varied between 0.61 and 2.07%. All alloys could be rolled without any difficulty both hot and cold. Cold forming kettles did not present any particular difficulties, though on bending the ware, alloys with more than 1.5% Fe cracked. After pickling, the ware was covered with a pronounced dendritic pattern of an unknown origin. (4c)

**Distortion of Steel Wires on Passing Through a Draw Plate.** H. QUINNEY. *Engineer,* Vol. 162, Nov. 6, 1936, pages 496-497. Experiments were made on 0.2 in. dead soft mild steel wire drawn through Durex and Widia dies to 0.1 in. diam. Although previous experiments showed that with Cu and Al the distortions are parabolic in all stages, it was found with mild steel that the distortions were finally parabolic but with a well-defined reflex curvature. This is particularly noticeable where a wire is reduced 75% in area in 3 drafts. Distortion in mild steel was found to be greater the larger the number of passes. The wire used for the tests had a tensile strength of 22.5 tons/in.$^2$ Making the reduction in 3 passes raised the tensile strength to 40.5 tons/in.$^2$; and in 6 passes to 37.5 tons/in.$^2$ This shows that the added distortion after 6 passes weakens the wire. Tables and diagrams of results are given. See also *Metals and Alloys,* Vol. 4, May 1933, page MA 152. LFM (4c)

## 4d. Machining

H. W. GRAHAM, SECTION EDITOR

**A Method of Handling Tungsten Carbide Dies Within the Die Room.** K. R. BEARDSLEE. *Wire & Wire Products,* Vol. 11, Oct. 1936, pages 553-559. Methods of servicing, recutting, finishing and grinding, and equipment needed are described. Ha (4d)

**Tools for the High-Nickel Alloys.** W. F. BURCHFIELD. *American Machinist,* Vol. 80, Oct. 7, 1936, pages 845-848. W high-speed steels of the 18-4-1 type with 0.7-0.75% C are most satisfactory for machining Monel metal and Ni alloys. Cuts, feeds and speeds for machining processes are given in tables. Ha (4d)

**Use of Turning Tools.** F. SCHWERDTFEGER. *Iron Age,* Vol. 138, Oct. 15, 1936, pages 163-164, 168, 170, 172, 174, 176, 178. Includes bibliography. VSP (4d)

**Effect of Heat Treatment on the Working Properties of Steels (Einfluss der Wärmebehandlung auf die Verarbeitungseigenschaften von Stählen)** W. LEVENSETTER. *Zeitschrift Verein deutscher Ingenieure,* Vol. 80, Oct. 24, 1936, pages 1299-1300. A few experiments demonstrating the dependence of machinability on pretreatment are described. Ha (4d)

**Progress in Machining of Light Metals Revealed at the 6th Foundry Exhibition, Düsseldorf (Fortschrittliche Bearbeitung von Leichtmetallen auf der 6. Giesserei-Fachausstellung Düsseldorf)** A. AUCHTER. *Aluminium,* Vol. 18, Dec. 1936, pages 625-628. Ha (4d)

**Machining a Locomotive Valve Gear.** K. J. COOK. *Railway Gazette,* Vol. 65, Aug. 14, 1936, pages 265-268. Secret of successful machining of the small number of large parts involved is provision of well designed jigs. Machining of twin eccentric sheaves, straps, rods, joint pins, links, shafts and other components is described. FPP (4d)

**Sawing Aluminum and its Alloys (Sciage de l'Aluminium et de ses Alliages)** *Revue de l'Aluminium,* Vol. 13, Sept.-Oct. 1936, pages 330-333. Efficiency is improved by easy flow of cuttings, i.e. the purer the metal the greater should be the inter-tooth space. For band saws the angle of clearance is preferably 30-40°, the tool angle 50-55° and the top rake 5-10°. The intertooth space may vary from 2.5-10. mm., the depth from 3-10 mm. The cutting speed is 1000-1200 m./min. and the feed 1-2 mm./sec. Dimensions of the band 0.8-1.2 mm × 20-60 mm. For circular saws, used for heavier sections and bars, angle of clearance is 30-35°, tool angle 55° and top rake 10-15°. Cutting speed is 100-500 (3000) m./min. with a feed of 100-50 mm./min. or 25-30 mm./min. with a feed of 120 mm./min. HR (4d)

# 5. HEAT TREATMENT

O. E. HARDER, SECTION EDITOR

**Defects in Heat Treatment.** A. A. ROBERTSON. *Heat Treating & Forging,* Vol. 23, Feb. 1937, pp. 81-83. Discusses ways in which defects may arise during treatment of small articles. MS (5)

**Heat Treating in Ball Bearing Manufacture.** C. T. HEWITT. *Heat Treating & Forging,* Vol. 23, Feb. 1937, pp. 63-66. Describes practice of Fafnir Bearing Co., New Britain, Conn., in heat treating rings, retainers, and balls. MS (5)

**Ultra-fine, Special-alloy Wire Processed with Gas Fuel.** R. H. MINTON (Public Service & Gas Co.). *Ind. Gas,* Vol. 15, Mar. 1937, pp. 7-8, 22. Production of ingots for heat and corrosion-resisting wires and furnaces for heat treatment are briefly discussed. Ha (5)

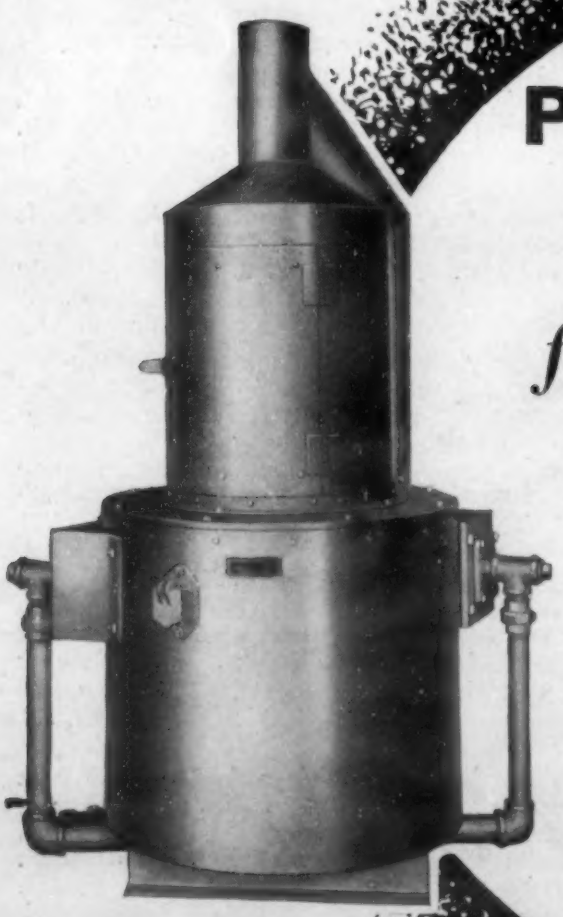
## 5a. Annealing

**Isothermic Annealing Hot Ingots and Forgings.** I. P. LIPILIN. *Kach. Stal,* Vol. 4, No. 10, 1936, pp. 12-22. In Russian. Steels containing: 0.70% C, 4.34 Cr, 18.50 W, 0.50 V; 0.35 C, 2.55 Cr, 7.70 W, 0.37 V; 0.90 C, 0.93 Cr, 1.27 W, 0.90 Mn; 1.09 C, 1.54 Cr; 0.40 C, 1.10 Cr, 3.50 Ni and 0.22 C, 1.42 Cr, 0.92 W, 4.18 Ni were cast into ingots or forged into heavy sections. When still hot they were charged into hot furnaces. They either were cooled with furnaces or subjected to isothermal annealing. Large number of hardness data reported in the paper indicate that isothermal annealing of hot metal results in considerable saving in time and improvement in quality of steel. See also *Metals and Alloys,* Vol. 8, Jan. 1937, p. MA 14L/4. (5a)

## 5b. Hardening, Quenching & Drawing

**Simplified Heat-treatment of Gray Iron (Traitement Thermique Simplifié des Fontes grises)** S. PILARSKI & L. SZENDEROWSKI. *Rev. Fonderie Moderne,* Vol. 31, Jan. 10, 1937, pp. 5-7; *Bull. Metallurg. Metallograph. Inst. Warsaw,* Vol. 3, No. 3, 1936, p. 119. Original research. Method of heat treating cast Fe was sought that would produce such cooling velocities that metallographic structures could be obtained equivalent to the best that can be produced. The results showed that cast Fe in general is susceptible to heat treatment and that ferritic-pearlitic cast Fe can be converted into pure pearlite, even though the total C and Si content amounts to 5.6%. Emulsion used as quenching agent consisted of 0.5% linseed oil in water saponified by ammonia; the salt baths used up to 500° C. were $NaNO_3$ and $KNO_3$ in equal parts, for higher temperatures 30% KCl, 30% NaCl, 20% $K_2SO_4$ and 20% $Na_2SO_4$. P, Cr-Ni, and Ni-Cr-Mo cast Fe's were investigated. The test results for each type are given in detail. Ha (5b)

**Surface Hardening Rolls for Cold Mills by Means of Oxy-acetylene Flame.** L. S. MOROZ. *Metallurg,* Vol. 11, Nov. 1936, pp. 69-78. In Russian. Rolls made of 0.8-0.9% C, 1.6-1.8% Cr steel and having max. diam. of 220 mm. were treated by mounting on a lathe and heating with a specially designed burner producing flame 255 mm. wide. For better distribution of heat a fireproof cover was placed on the roll during heating. When the rolls were properly heated on the surface this cover was removed and replaced with a water spray producing necessary cooling effect. Any depth of hardness penetration was possible with this arrangement, which is described in detail both from theoretical and practical standpoints. Greatest advantage claimed is much reduced internal strains. (5b)

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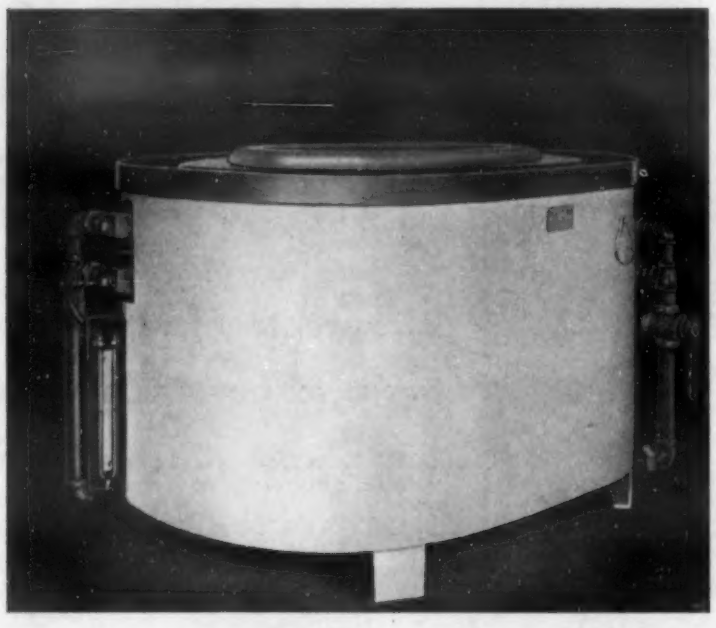

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**Thermal Treatment of Cr-Mo and Cr-Si-Mn steels.** O. VOLKOVA. *Metallurg,* Vol. 11, July 1936, pages 92-98. In Russian. The theory that double tempering after quenching improves physical properties of steels was checked. Sheets 22 mm. thick were quenched from their critical range in well agitated oil. Then they were drawn at 300-500° C. and redrawn at 140-250° C. Second drawing slightly reduces elongation obtained on first drawing at 500° C., but practically does not affect results produced on lower draw. No advantage in using double drawing could be found. (5b)

**Precipitation Hardening of $Mg_2Si$-containing Aluminum-magnesium Casting Alloys (Beiträge zur Frage der Aushärtung $Mg_2Si$-haltiger Aluminium-Magnesium Gusslegierungen)** E. KRÖNER (I. G. *Farbenindustrie*Q *Aluminium,* Vol. 19, Feb. 1937, pp. 58-65. The improvements in hardness obtainable by heat treatment of casting alloys, both chill-mold and sand casting, are discussed on the basis of tests made on alloys in the Al corner of the ternary system Al-Mg-Si, and in particular that section of this system Al-$Mg_2Si$ which shows a quasibinary eutectic at about 13% $Mg_2Si$. Although the relatively rapid cooling in chill-mold casting results in a fairly fine structure, a very coarse crystallization takes place in sand-casting. The possibility of successful heat-treatment depends on the solubility of $Mg_2Si$ in Al, which is reduced by even small excess of Mg. These conditions are exhaustively treated for different temperatures and Mg-contents. Casting temperature has a strong influence on tensile strength, elastic limit and elongation. It can be stated that precipitation-hardenable alloys of eutectic and hypoeutectic composition cannot be produced. It was found that the bad effect of excessive Mg (or $Mg_2Si$) content can be obviated by small additions of Ce, eventually together with Zn and Mn, as hereby the coarser $Mg_2Si$ crystals are modified to harmless, finely distributed silicides. Curves illustrate the mechanical properties as dependent on temperature for $Mg_2Si$ hardening. Ha (5b)

**Sorbitization of Kerch Rails.** V. DATTA & P. IVANOV (Voikov Met. Plant) *Stal,* Vol. 6, June 1936, pp. 67-77. In Russian. Practical. These rails are rolled from basic converter steel and contain 0.076-0.144% As. Quenching the head in water increased the tensile strength to 128,000-142,000 lbs./in.$^2$. HWR (5b)

## 5c. Aging

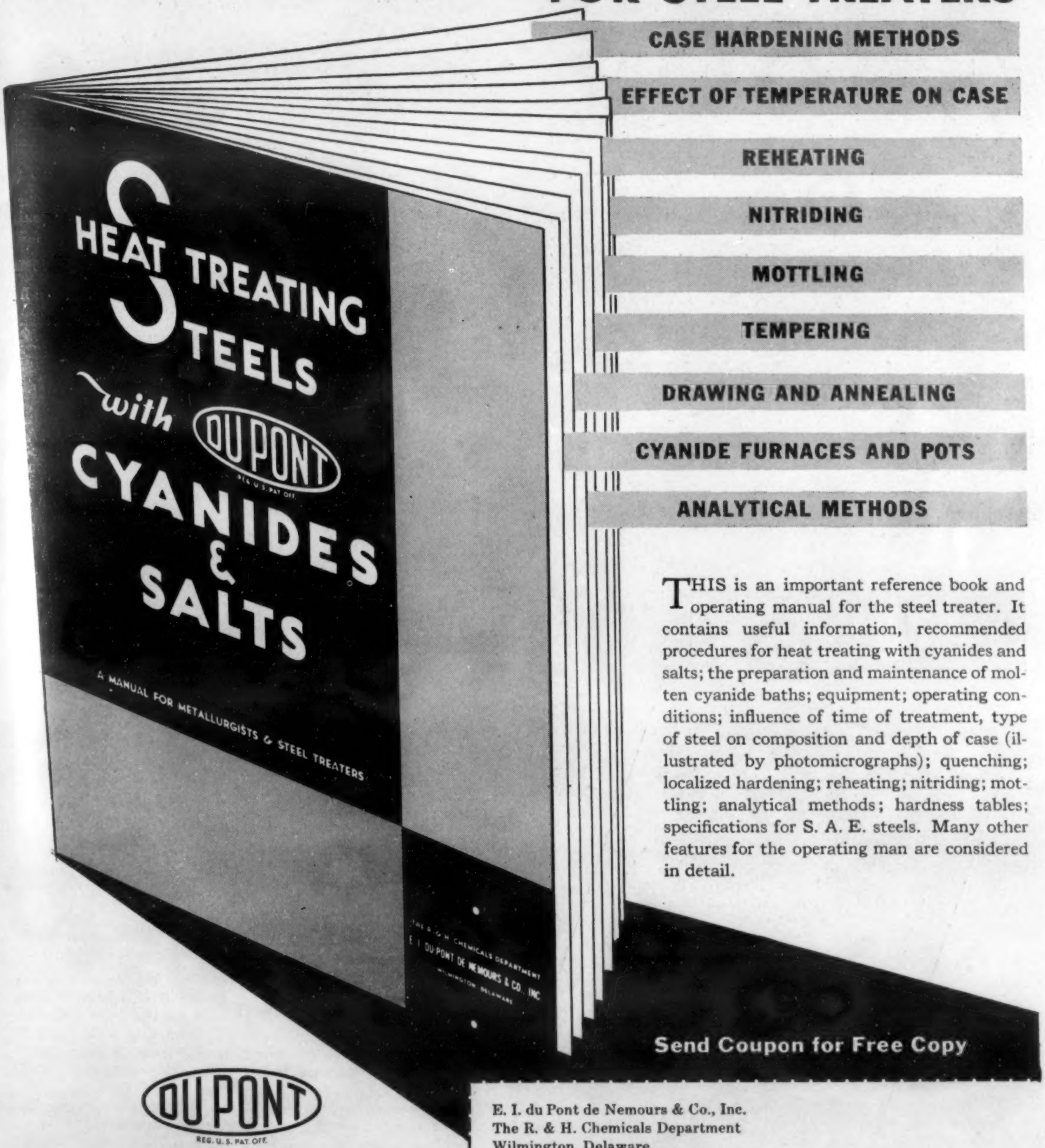
**On Age-hardening Mechanism in Al-$MgZn_2$ Alloys.** SADAJIRÔ KOKUBO. *Kinzoku no Kenkyu,* Vol. 14, Jan. 1937, pp. 1-10. In Japanese. *Sci. Repts. Tôhoku Imp. Univ.,* Vol. 25, Honda Anniversary Issue, 1936, pp. 694-701. In English. In order to investigate the mechanism of age-hardening in Al-Mg dizincide alloy, a study was made on on alloy containing 15% $MgZn_2$ quenched from 450° in water after being heated at that temperature for 30 minutes followed by aging at room temperature for several days and tempering for 6 hrs. at 60, 100, 150° C., etc., respectively, and then cooling slowly in the furnace. The variation in density, electric resistanace, and hardness of the specimen due to these heat treatments was measured, dilation and thermal curves of the quenched specimen during slow heating (2.5° C. per min.) were also taken. The result of measurements was explained very satisfactorily on the basis of Honda's theory that the process of precipitation may occur in three steps as in the case of Al-Cu and Al-$Mg_2Si$ alloys. The three steps are (a) Mg and Zn atoms migrate within the lattice of Al and assemble themselves to a configuration suitable for the formation of the compound, while hardness and electric resistance increases in this stage; (b) a group of these atoms is precipitated as the compound above 100° C., while hardness and electric resistance decrease, specific gravity increases abruptly and heat is generated in this stage; (c) then these molecular groups assemble themselves and build up a space lattice characteristic of the compound. These processes may take place in close succession or partially overlapping. KT (5c)

## 5f. Nitriding

**X-ray Determination of Thermal Expansion Coefficients of Iron Nitrides.** G. F. KOSOLAPOV. *Metallurg,* Vol. 11, Nov. 1936, pp. 79-86. In Russian. Coefficients of thermal expansion were determined by the powder method. Procedure used is fully described. Average value obtained for $Fe_4N$ was $a = 0.79 \times 10^{-5} \pm 0.07 \times 10^{-5}$; this is 42% higher than that of pure Fe. Average lineal coefficient of expansion of $Fe_2N$ was given as $a = 2.22 \times 10^{-5}$, which was 40% greater than that of pure Fe. Difference in expansion between nitrided case and Fe core frequently causes warping of articles having asymmetrical shape. (5f)

# *Practical information*

## FOR STEEL TREATERS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# 6. FURNACES, REFRACTORIES AND FUELS

M. H. MAWHINNEY, SECTION EDITOR

**Influence of Degree of Firing on the Properties of Cement (Einfluss des Brenngrades auf die Eigenschaften des Zementes)** G. MUSSGNUG. *Mitt. Forsch. Anstalt. Gutehoffnungshütte Oberhausen, A. G.,* Vol. 5, Jan. 1937, pp. 13-24. Original research. The properties of Portland cement bricks made of sulphide-containing blast furnace slag were investigated. Very sharply fired bricks showed inferior properties to less sharply fired bricks. The most favorable content of $SO_3$ is about 1-1.5%; higher content reduces the compressive strength. The $SO_3$ content in the brick depends on the firing process, excess of air and firing temperature; a long flame and correspondingly long sintering zone are advantageous. 9 references. Ha (6)

**Refractory Trends and Developments During 1936.** JOHN D. *Sullivan. Blast Furnace & Steel Plant,* Vol. 25, Jan. 1937, pp. 88-91. *Heat Treating & Forging,* Vol. 23, Jan. 1937, pp. 27-30. Review with bibliography. Outstanding development is successful installation of $Cr_2O_3$-MgO roofs in European open-hearth steel-melting furnaces, whereby increased furnace temperatures are attainable. MS (6)

**A Comparison of the Thermal Expansion of Used Silica Brick from an Insulated and an Uninsulated Open-hearth Furnace Roof.** R. H. H. PIERCE, JR., & J. B. AUSTIN. *J. Amer. Ceram. Soc.,* Vol. 19, Oct. 1936, pp. 276-287. Limit of Fe oxide penetration shown to be 1100° C. where CuO-FeO-$SiO_2$ eutectic exists. This has abrupt change in expansion and is therefore a weak zone for any brick where cold end temperature is below 1100° C. Cristobalite inversion at 250° C. is responsible for failure by spaling. Conductivity of that part of brick penetrated by Fe oxide and of rest of brick was estimated from the data; former is higher and has negative temp. coefficient while unaltered part has positive temp. coefficient. WB (6)

**Testing Refractories Against the Corrosive Action of Electric Furnace Phosphate Slags.** GORDON R. POLE & D. G. MOORE. 2 *J. Amer. Ceram. Soc.,* Vol. 19, Oct. 1936, pp. 259-270. Description of tests of various brick made in phosphate slag obtained in electric furnace reduction of phosphate rock. Analysis, physical properties, test results are tabulated for the brick tested. Results of petrographic analyses are given in micros which indicate reasons for corrosion resistance. SiC brick shows best resistance. WB (6)

**Small Refractory Crucibles for Laboratory Work.** M. RIDDIHOUGH. 3 *Iron Steel Ind.,* Vol. 10, Jan. 1937, p. 241. Describes mold design for production of small crucibles. Recommends crushed Alundum fired at over 1600° C. for steel melts. CMS (6)

**The New Coke Oven and By-product Plant at the Govan Iron Works.** THOMAS RITCHIE. *J. West Scot. Iron Steel Inst.,* Vol. 44, Oct. 1936, pp. 1-19. Descriptive. The plant comprises 50 underjet compound regenerative ovens with equipment for coal and 4 coke handling and a complete by-product recovery plant. The daily capacity is 500 tons of screened blast furnace coke. FGN (6)

**Cleaning and Pickling Tanks Heated by Simple Economical Gas Method.** J. B. NEALEY. *Steel,* Vol. 100, Feb. 22, 1937, pp. 60, 62, 73. Gas immersion heaters, in which gas burners fire into tubes or coils spaced above bottom of tanks, afford economical and efficient heating of solutions. Wood and metal tanks can be 5 so heated. Common Fe and steel pipes are satisfactory with ordinary cleaning solutions. Pb tubes are used with acid tanks. Where explosive gases are present, totally enclosed burners are available. MS (6)


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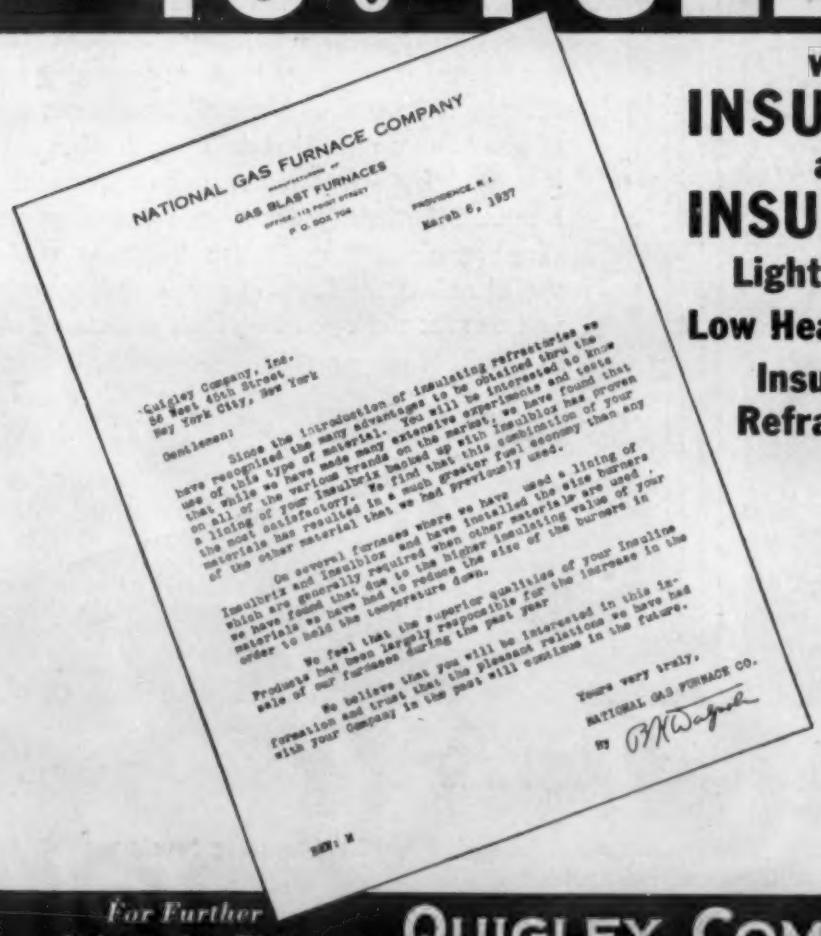
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We feel that the superior qualities of your Insuline Products has been largely responsible for the increase in the sale of our furnaces during the past year.
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Yours very truly,
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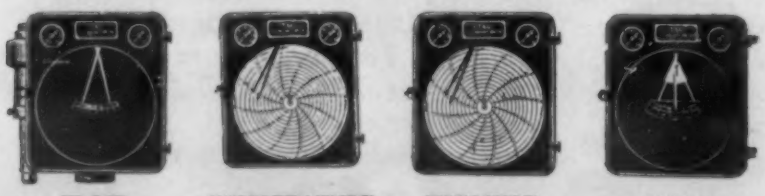

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**The Mathematical and Graphic Determination of Gas Radiation (Die mathematische und zeichnerische Darstellung der Gasstrahlung)** H. SCHWIEDESSEN. *Arch. Eisenhüttenw.*, Vol. 10, July 1936, pp. 19-28. Formulas and graphs given for determining the
1 gas radiation for various gases and furnace chambers. SE (6)

**Heat Insulation: The Selection of Suitable Materials for Various Purposes.** J. S. F. GARD. *Iron & Coal Trades Rev.*, Vol.
— 134, Feb. 12, 1937, pp. 299-300. Temperature gradients in the walls of high-temperature furnaces is discussed as they are affected by the composition of the wall. By examples it is shown how correct selection of material and thickness of refractory and insulat-
2 ing material provides economies in material and fuel. The development of brick combining both good refractory and insulating properties will be advantageous. Ha (6)

— **Temperature Attained and Rate of Heating of Work in Pusher Type Furnaces (Temperatur und Durchwärmung des Wärmgutes im Stossofen)** W. HEILIGENSTAEDT. *Arch. Eisenhüttenw.*, Vol. 10, Oct. 1936, pp. 131-137. Original research. Temperature measurements were made at points along the cross-
3 section of ingots of C and alloy steel up to 400 mm. thick heated to about 1300° C. in various type furnaces. Curves show the temperature differences between surface and center during heating in the various sized ingots. SE (6)

— **Electrically Heated Lead-melting Furnaces for Cable Presses (Elektrischbeheizte Bleischmelzen für Kabelmantelpressen)** H. HÖLTJE. *Elektrowärme*, Vol. 6, Dec. 1936, pp. 336-338. Pb losses and formation of Pb oxides can be reduced by heating the
4 Pb melts electrically, as overheating can be more easily avoided than in fuel-heated furnaces. A large press and Pb melting furnace of 1500-1800 kg./per hr. with a capacity of 600 kg. Pb, operating temperature of 400° C. and power consumption of 75
— kw. is described. Ha (6)

**Heating-up Time and Energy Consumption of Electrical Furnaces (Anheizzeit und Anheizverbrauch elektrisch beheizter Oefen)** K. MERTENS. *Elektrowärme*, Vol. 6, Dec. 1936, pp. 338-
5 342. Practical. As shown by an example, correct furnace design reduces stored heat and idling losses with greatly improved economy. Ha (6)

— **Radiant Tube Furnace Reduces Fuel Costs in Porcelain Enamel Firing.** J. B. NEALEY. *Steel*, Vol. 99, Dec. 14, 1936, pages 52, 60. Describes enameling furnace heated by gas-heated radiant tubes located on inside walls and bottom. Newly designed dif-
6 fusion-type burner is used with tubes. MS (6)

**Inland Open-hearth Furnaces Possess Novel Features.** CHARLES LONGENECKER. *Blast Furnace and Steel Plant*, Vol. 24, Oct. 1936, pages 885-886, 889-890, 892. Describes design of 4 new 150-ton
— open-hearth furnaces being erected by Inland Steel Co. at Indiana Harbor, Ind. MS (6)

**Control Instruments for Basic Open-hearth Furnaces (Die**
7 **messtechnische Ueberwachung von Siemens-Martin-Oefen)** COMMITTEE REPORT. *Stahl und Eisen*, Vol. 56, Oct. 8, 1936, pages 1236-1239. Instruments for measuring the amount of incoming and outgoing gases and of the drafts and temperatures in the re-
— generative chambers are illustrated. The control board should be kept clean and located near the furnace. SE (6)

**A New Electric Furnace.** *Engineer*, Vol. 162, Dec. 18, 1936, page 665. Brief description of a new portable electric furnace for
8 the normalizing of welded pipe joints, introduced by Metalectric Furnaces, Ltd. of Birmingham. LFM (6)

— **Of What Value to Aluminum and Light Alloys are Induction Furnaces? (Quels Services peuvent rendre les Fours à Induction à lAluminium et aux Alliages' légers?)** J. J. BALLY. *Revue de l'Aluminium*, Vol. 13, Nov. 1936, pages 433-439. A new low-
9 frequency induction furnace developed by Ugine-Infra is described. The new furnace, which is provided with automatic temperature control, is said to overcome many of the disadvantages previously linked with the use of induction furnaces for light-alloy melting. HR (6)

— **Open-hearth Checkerwork Designs.** GEORGE L. DANFORTH, JR. *Blast Furnace and Steel Plant*, Vol. 24, Oct. 1936, pages 899, 920-921; Nov. 1936, pages 981-983. Paper read at meeting of Open-hearth Committee of the American Institute of Mining and
10 Metallurgical Engineers. Lists more important features to incorporate in checkerwork design to gain best overall results in regenerator chamber; points out and illustrates characteristics of older designs; and deals more fully with the Danforth-Peterson system, devised for use with superior results in single- or multiple-pass regenerators. MS (6)

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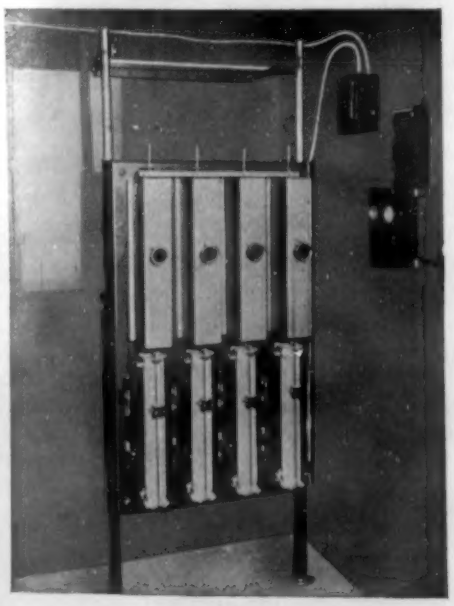

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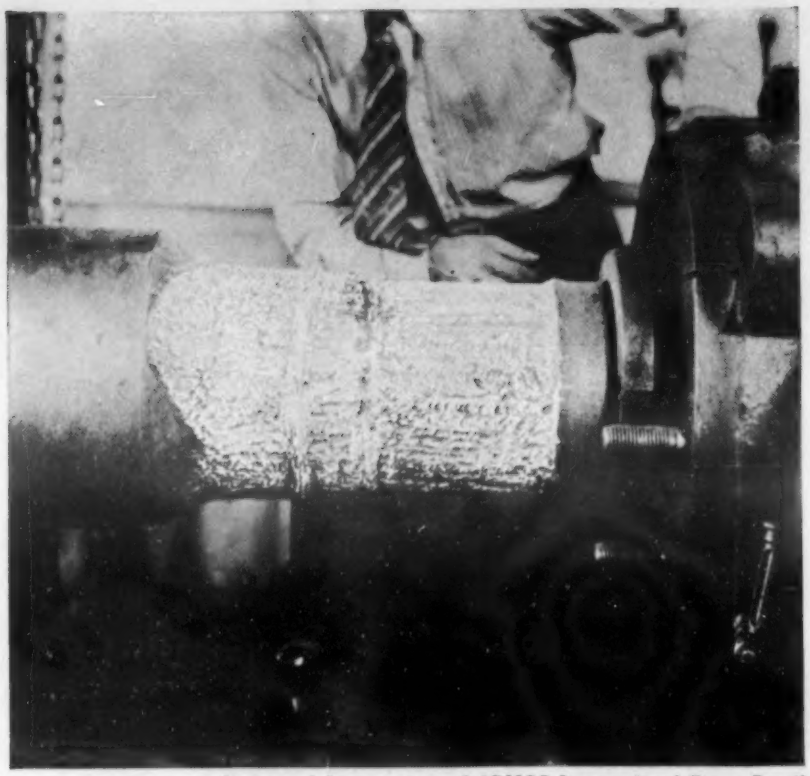

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# 7. JOINING

**Tips on Carbide Tipping.** F. W. CURTIS. *American Machinist,* Vol. 80, Dec. 16, 1936, pages 1031-1033. Procedure is described in detail. Ha (7)

## 7a. Soldering & Brazing

C. H. CHATFIELD, SECTION EDITOR

**Liquid Brazing.** J. M. G. TURNBULL, *Engineer,* Vol. 162, Dec. 11, 1936, pages 622-625; Dec. 18, 1936, pages 648-650. Laboratory tests were carried out to improve the process of brazing stainless Fe containing 13.5% Cr and less than 0.12% C by immersion in molten brass. Dilute $HNO_3$ was found to be an excellent pickling agent. Various fluxes were tested and it was found that borax is as suitable as any. The brazing metal used was 70/30 brass and it becomes contaminated with Fe, as it attacks the steel segments. When the Fe content becomes higher than 1.5%, 50% of the brazing metal is renewed. The addition of Al to reduce volatilization of Zn was unsuitable with borax as a flux, as the Al becomes oxidized by the borax and a crust of alumina is formed. To remove the coating of borax glass after brazing a pickle in boiling 3% $HNO_3$ with inhibitor was the most effective. The temperature for best results is about 1000° C. at the surface of the borax. Lower temperatures give unsatisfactory joints and higher temperatures cause evolution of Zn which results in defects from gas inclusions. Best results are obtained with spaces of 0.025 in. on both sides of the blades. If a closer space is allowed gas and borax inclusions cannot escape and if a wider space is left the brass runs out. Tables, diagrams and photomicrographs are given. LFM (7a)

## 7b. Welding & Cutting

E. V. DAVID, SECTION EDITOR

**Contribution to the Welding of Steels of High Tensile Strength (Beitrag zur Schweissung von Stählen höherer Festigkeit)** R. BRENNECKE. *Elektroschweissung,* Vol. 7, Aug. 1936, pages 151-155. The increasing use of steels of high tensile strength as St 60 and St 70 led to the development of an alloyed rod with special coating. Tensile strength as high as 106,000 lbs./in.$^2$, and high notch impact strength are obtained. Micrographs are included. HR (7b)

**Wide Range of Shapes Is Produced by Automatic Flame Cutter.** *Steel,* Vol. 99, Oct. 12, 1936, pages 71-72. MS (7b)

**Recent Developments in Hydro-electric Engineering.** P. W. SEEWER. *Engineering,* Vol. 142, Dec. 25, 1936, pages 692-695, 703-704. The development of welded structures and stainless steel protective welding discussed. LFM (7b)

**Hard Metal Applications Prove a Boon to Industry.** D. E. STALEY. *Welding Engineer,* Vol. 21, Sept. 1936, pages 52-54. Hard facing first used in oil industry for well drilling. Since been applied to numerous uses where wear resistance or self sharpening characteristics resulted in saving of power, equipment or maintenance time and labor. Failure of hard surfacing in some cases due to too heavy application, wrong base material. Makers of new equipment are reluctant to use hard facing due to loss of replacement part business. WB (7b)

**Principles of Surfacing by Welding.** E. W. P. SMITH. *Welding Journal,* N. Y., Vol. 15, Oct. 1936, pages 31-33. Reasons for surfacing with hard material are improvement in service life, reduction in over-all costs, reduction in operating cost. The characteristics of the surface deposited and resistance to various services are discussed. Surfacing may be done with higher C steel which can then be peened or heat treated to higher hardnesses. Alloy steel surfacing, air hardening, required where there is impact service. Weld-surfacing lends itself to preparation of composite tools with cutting edges and abrasion resisting sides composed of various alloys best suited for individual service. Curves and charts are given to enable quick computation to be made of cost of surfacing cheaper base metal as compared with a tool composed entirely of a single metal. WB (7b)

# News for Tank Manufacturers

## IMPROVED METHOD SOLVES PROBLEM OF ATTACHING "SPUDS" TO NON-FERROUS TANKS

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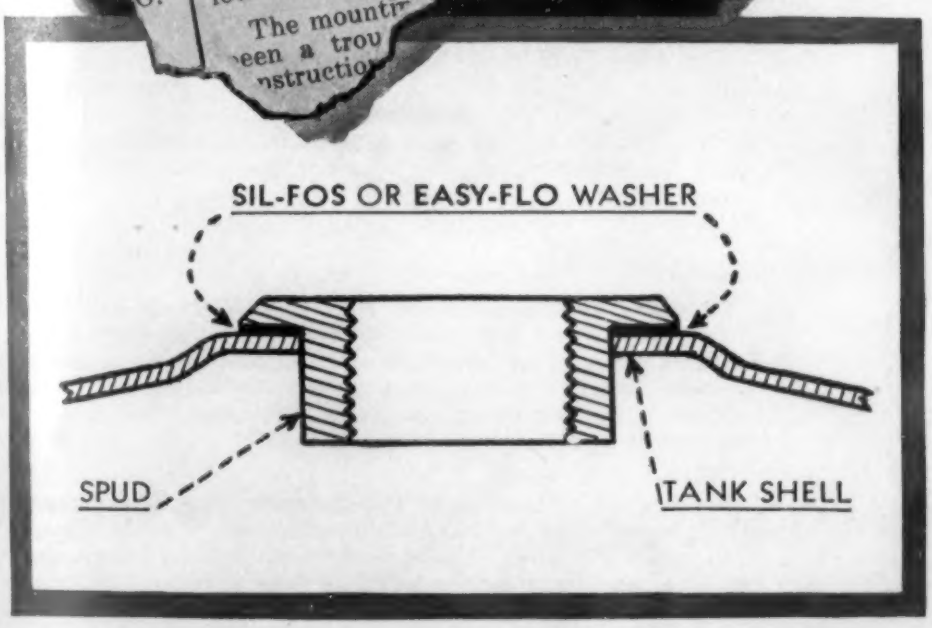


## . . . Here's the Method

*For Copper Tanks* — After proper cleaning and fluxing, a thin washer of SIL-FOS Brazing Alloy is placed between the spud flange and tank shell and clamped in place. The assembly is then heated with a torch to 1300° F., when SIL-FOS, flowing freely, alloys with the metals making an indestructible bond between tank and spud. Best results are obtained by using the low temperature HANDY FLUX.

*For Monel Metal, Everdur and other Copper-Nickel Tanks* — The method is exactly the same, but EASY-FLO Brazing Alloy is used, which flows freely at 1175° F.

***Washers made of SIL-FOS and EASY-FLO are available in a range of diameters and thicknesses to meet any requirement.***

## Here are the Advantages

Low Temperature Brazing makes sound joints without damaging the physical qualities of the metals joined.

Spud costs are less — no outside threads or locknuts are required on the spud shanks.

The cost of SIL-FOS and EASY-FLO washers is surprisingly low.

The neat joints SIL-FOS and EASY-FLO make, require little cleaning, if any.

SIL-FOS and EASY-FLO joints give strengths as high as the metals joined and withstand severe shock, vibration and wide temperature changes. They are also highly resistant to many kinds of corrosion.

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*If you have a spud brazing problem, we'll be glad to send a field engineer to help you solve it . . . and to demonstrate this low temperature brazing method to you. No obligation. Write today.*

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**Industrial Application of Two-row Welding Method (Application des Méthodes de Soudures à Double Cordon)** MESLIER. *Usine,* Vol. 45, Oct. 15, 1936, page 35. 3 types of double-row welding methods, all performed from bottom up, are described. Best method uses 2 flames on opposite sides of the work, without tapering the edges, and is suitable for sheets up to 12 mm. Ha (7b)

**Economical Production of Large Containers by Autogenous Welding (Wirtschaftliche Fertigung von Grossbehältern durch Autogenschweissung)** H. H. GRIX. *Autogene Metallbearbeitung,* Vol. 29, Oct. 15, 1936, pages 308-309. Welding procedure involving 2 welders working simultaneously on both sides of the same seam, from the bottom up is described, as used for large boilers, tanks, etc. Advantages cited are quicker welding, elimination of edge-beveling, saving of $O_2$ and $C_2H_2$. Ha (7b)

**Recent Advances in the Technique of Welding.** E. DACRE LACY. *Shipbuilding and Shipping Record,* Special Number, Dec. 30, 1936, pages 24-27. Reviews recent advances in welded ship construction, welding practice in warship construction, welding of gun mountings and marine pressure vessels. Consideration is given to oxy-acetylene welding, as complementary to electric arc welding. JWD (7b)

**Shape Cutting of Locomotive and Car Parts in Railroad Shops.** JAMES GRANT. *Southern & Southwestern Railway Club Proceedings,* Vol. 23, Mar. 1936, pages 8-19; *Welding Ind., London,* Vol. 4, Mar. 1936, pages 55-57. Procedure and equipment for cutting heavy parts with the oxy-acetylene flame are described. See *Metals and Alloys,* Vol. 7, Apr. 1936, page MA 190R/5. Ha + WB (7b)

**Present State and Utilization of Welding by the Austrian State Railroads (Derzeitiger Stand und Anwendung der Schweisstechnik bei den Österreichischen Bundesbahnen)** JOHANN TITSCHER. *Organ für die Fortschritte des Eisenbahnwesens,* Vol. 91, Sept. 1, 1936, pages 360-366. Describes the main Austrian railroad welding shop at Linz and gives a practical, instructive account of welding jobs performed on rails and rolling stock. WH (7b)

**The Production of High-grade Welded Joints (Verfahren zur Erzeugung hochwertiger Schweissverbindungen)** K. VIGENER. *Zeitschrift Verein deutscher Ingenieure,* Vol. 80, Sept. 5, 1936, pages 1111-1112. The new electric welding process of Kautz (DRP 567,094) is briefly described. The process is unconventional in that uniformity of weld structure is purposefully avoided. For welding mild steel, cast Fe, cast Si and structural steels, electrodes of austenitic Cr-Ni steel are employed, assuring an austenitic seam. The intermediate zone is of a martensite-like structure, a few 1/100 mm. thin. In these zones the notch toughness was even higher than in the parent material. Tensile, bending, quenching and forging tests gave results equal to best Izett steels. Austenitic weld was highly resistant to aging. Method has been adopted for boiler welding. Ha (7b)

**Welding Sensitivity (Zur Frage der Schweissempfindlichkeit)** K. L. ZEYEN. *Zeitschrift Verein deutscher Ingenieure,* Vol. 80, Aug. 8, 1936, pages 969-973. See *Metals and Alloys,* Vol. 7, Dec. 1936, page MA 590R/9. Ha (7b)

**Residual Stresses in Arc-welded Plates.** N. S. BOULTON & H. E. LANCE MARTIN. *Mechanical World & Engineering Record,* Vol. 99, May 29, 1936, pages 542-544. Paper before the Institution of Mechanical Engineers reports tests to determine the longitudinal residual stresses which remain in a long, flat mild steel plate after depositing a layer of weld metal in a practically continuous run, either along one or simultaneously along both, of its long edges. See *Metals and Alloys,* Vol. 7, Dec. 1936, page MA 590L/9. WH (7b)

**Welding and Cutting Steel Alloys.** F. C. HASSE. *Southern & Southwestern Railway Club Proceedings,* Vol. 23, Mar. 1936, pages 19-32. With discussion. The fabrication of railroad equipment by welding and cutting with particular regard to the use of alloy steels is discussed according to the different kinds of steel, and the procedures to be observed for different compositions are described. Ha (7b)

**Welding of Zinc Sheet (Zinkblechschweissung)** H. A. HORN. *Autogene Metallbearbeitung,* Vol. 29, Oct. 15, 1936, pages 305-308. Methods and difficulties of welding Zn are discussed. Pure Zn can satisfactorily be welded, but commercial Zn sheets are more difficult because of the impurities and the coarse crystalline structure. Post-welding hammering should be done only at 150° C. Tests are described in which a new flux (composition not given) was used with good results. See *Metals and Alloys,* Vol. 6, Sept. 1935, page MA 364R/5. Ha (7b)

**Steel for Arc-welding Electrodes.** R. NOTVEST. *Wire & Wire Products,* Vol. 11, Oct. 1936, pages 527-551. An exhaustive study is made of the metallurgical characteristics of drawn wire to be used for electrodes; their behavior in the arc-welding process, and the chemical reactions occurring in the arc are described in full, and the effect of the slag formed on the weld discussed. Metal admixtures to welding rod coatings capable of an exothermic reaction under the arc are, according to experience, best made of C, Mn, Si, Al and Ti. Reactions for each individual metal, and micrographs illustrating weld structures, are given. Ha (7b)

**Welded Supports (Geschweisste Stützen)** J. SEHRING. *Autogene Metallbearbeitung,* Vol. 29, Oct. 15, 1936, pages 309-311. Supporting structures welded from pipes and profiles with high safety under compressive stresses are described. Ha (7b)

**Jigs and Fixtures for Resistance Welding Machines.** H. C. COGAN. *Sheet Metal Industries,* Vol. 10, Sept. 1936, pages 715-718, 720; Oct. 1936, pages 799-800. A contribution for the proposed Welding Handbook of the American Welding Society and printed in their *Journal.* Defines "fixture" as being a work holding and locating device that is bolted or fastened to a standard welder, while a "jig" is considered an appliance for holding and locating the work. Thirteen rules of design of these devices are set forth. Some typical jig applications are illustrated. See *Metals and Alloys,* Vol. 7, Dec. 1936, page MA 588R/5. AWM (7b)

**Arc Welding of Sheet Metal. The Advantages of Rectified Current.** S. G. P. DE LANGE. *Sheet Metal Industries,* Vol. 10, Sept. 1936, pages 711-712. The requirements of d.c. output, fine and accurate current control, absence of electrical inertia, and a quiet, flexible arc are met with a transformer-rectifier combination. Rectifiers are provided with oxide cathode rectifying tubes which permit the current to pass in only one direction. Welders have welded 3 ft. of 20 gage plate in 2¼ to 2¾ min. AWM (7b)

**Present State of Welding Technique (Der Stand der Schweisstechnik)** W. ZIMM. *Die Wärme,* Vol. 59, Oct. 3, 1936, pages 646-651. Survey discussing: oxy-acetylene welding, effect upon microstructure, evolution of arc-welding, microstructure, welding stresses, corrosion stability, materials for welding, training of welders. EE (7b)

**Cast Iron Parts Successfully Repaired by Arc-welding.** A. F. DAVIS. *Modern Machine Shop,* Vol. 9, Nov. 1936, pages 81-88. Procedure is described by which cast Fe can be welded satisfactorily. The casting should be kept cool by using a low-heat electrode, the weld metal should be deposited in short lengths which should be allowed to cool and curved line welds rather than straight line should be used wherever possible, to reduce strains. Ha (7b)

**Accurate Time Control for Resistance Welding.** R. T. GILLETTE. *Sheet Metal Industries,* Vol. 10, Aug. 1936, pages 633-634. Extract from a paper before the Detroit Section of the American Welding Society. A discussion of the application of Thyratron controls to welding operations on stainless steel. See *Metals and Alloys,* Vol. 7, Nov. 1936, page MA 536R/7. AWM (7b)

**Welding of Bronze Bells (Schweissung von Bronzeglocken)** H. A. HORN. *Autogene Metallbearbeitung,* Vol. 29, Dec. 15, 1936, pages 377-381. The difficulties of welding bronze due to the rapidly reduced tensile strength with increasing temperature (at 600° C. only 20% of that of normal temperature) are discussed and the best procedure to make oxy-acetylene welds is illustrated by several examples of welding broken bells of historical interest. Ha (7b)

**Repair of a Cast Iron Vise by Autogenous Welding (Instandsetzung eines gusseisern Schraubstocks durch autogene Schweissung)** K. MÜLLER. *Autogene Metallbearbeitung,* Vol. 29, Dec. 1, 1936, pages 360-361. Procedure is described; repair could be made for 35% of replacement cost. Ha (7b)

**Sealed Off Ignitrons for Welding Control.** DAVID PACKARD & J. H. HUTCHINS. *Electrical Engineering,* Vol. 56, Jan. 1937, pages 37-40, 66. Accurate control of high currents for resistance welding may be obtained by igniter-type Hg-cathode tubes capable of conducting 7000 amp. in impulses of from less than 0.01 sec. to several seconds' duration. The principles and manufacturing technique of tubes of the sealed off type are described. Advantages claimed include: (1) absence of moving parts, (2) flexibility, short timing and accuracy of control, (3) permissibility of direct connection in the primary circuit of the welding transformer, (4) stability, (5) ease of replaceability, and (6) small size. 8 references. WHB (7b)

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BUILDER OF BETTER WELDING ELECTRODES IN ALL ANALYSES

**Spot Cash by Spot Welding Aluminum Alloys in Production.** C. WESTON STEWARD. *Aviation,* Vol. 35, Aug. 1936, pages 29-31. Description of special equipment and practice used by Chance Vought Aircraft in making more than 12,000 spot welds a day with Al alloys. Heat-treated materials up to ⅛" thick with arms set at 10" gap can be welded. 1/16" stock may be welded using either a 20" gap or the vertical arm. General production problems, the preparation of the surface, and welding technique are described. Spot welding costs much less than riveting. **On the Spot.** *Idem,* Sept. 1936, pages 25-27. With equipment described in the previous article the 3 variables (pressure-current-time) that affect the quality of the work were studied. Curves of pressure, current and time for various thickness of 24 ST Alclad recommended by various authorities are plotted and discussed. FPP (7b)

**Welding of Underground Pipe Lines.** H. E. TEAGUE. *Mechanical World & Engineering Record,* Vol. 99, May 1, 1936, pages 445-446. Paper before the South African Institution of Engineers states that the sleeve type of joint has been found to be very satisfactory in the fabrication of long welded pipe-lines. The quickest method is to weld lengths on to the main well ahead, allowing the pipe to fall gradually to its final level as the work proceeds. WH (7b)

**Safety in Fusion Welded Joints.** E. R. FISH. *Locomotive,* Vol. 41, July 1936, pages 74-83. Procedures of welding conducive to good welds, and testing methods are discussed in general. Ha (7b)

**Inspection of Welded Seams in Pressure Vessels.** WM. D. HALSEY. *Locomotive,* Vol. 41, Jan. 1936, pages 2-7. Discusses a number of boiler explosions caused by unsound welds, i.e. a fusion welded joint in which the weld metal was not properly fused to the base material so that no adequate bond existed between weld metal and the plate. An investigation of the material after an explosion by trepanning plugs from it is described in detail. See *Metals and Alloys,* Vol. 7, Oct. 1936, page MA 500L/2. Ha (7b)

**The Distribution of Stresses in Fillet Welds.** DAVID VICTOR ISAACS. *Journal of the Institution of Engineers of Australia,* Vol. 8, Aug. 1936, pages 286-294. The author discusses critically the existing work on the distribution of stresses alongside fillet welds. He then details some of his experimental and theoretical research work on the subject and concludes that the past theories have been seriously in error. Some light is thrown on the fatigue resistance of welds. Some of the accompanying 73 illustrations show how side welds should preferably be placed to obtain the best stress distribution and the greatest ratio of strain to stress. Side welds should—if possible—be run to the ends or edges of members and used in combination with end welds where possible. The general joint form should be such as would indicate smooth stress flow and should be neither too long nor too short. Intermittent fillets can be regarded as having fatigue properties only slightly inferior to continuous fillets, other factors being equal. Butt welds should be used where possible. Fatigue failures in fillet welds will be originally divisible and may result from working stresses 100 to 20% of the usual static values. WH (7b)

**Welded Structures in the Construction of Locomotives (Schweisskonstruktionen beim Bau von Lokomitiven)** E. KALISCH. *Technische Mitteilungen Krupp,* Vol. 4, Nov. 1936, pages 164-168. The German state railways have permitted the use, after careful experiments, of welded construction in many vital parts of the locomotive; even the firebox, usually made of Cu was replaced by one of Izett steel (with and without Mo addition) and it was proved that this steel offers a great security against the intercrystalline corrosion often met in other steels. Examples of welded frames, cylinder and other parts with test results are described. Ha (7b)

**Izod Tests on Fusion-welded Boiler Drums.** L. W. SCHUSTER. *Sheet Metal Industries,* Vol. 10, Nov. 1936, pages 885-890. It was found that there was no reduction of Izod value with plate thickness. Top runs in welds showed consistently lower impact values than the metal in lower runs. Slow cooling of N-bearing welds after heat treatment resulted in heavy nitride needle formation. AWM (7b)

**Electrically Deposited Cutting Edges Reduce Tool Costs.** E. W. P. SMITH. *Machinery,* N. Y., Vol. 43, Jan. 1937, pages 306-307. A new arc-welding electrode is described which can be deposited on a softer metal, like cold-rolled steel, to give a cutting edge equal to that of high speed steel, and with which worn edges of tools can be built up. This weld material (composition not given) has a hardness of 55-65 Rockwell C and maintains this hardness up to 1000° F. Ha (7b)

**Suitability of Welds for Hard Surfacing.** ALBERT ROUX. *The Welder,* No. 8, No. 35, Oct. 1936, pages 1101-1106. The cause of irregular hardening of hard-surfaced welds was investigated as to chemical composition of the filler metal, nature of the weld-rod coating and its thickness, electric and gas welding process. A series of 10 compositions of deposited metal was tested, as laid down by torch (two compositions) and by electric arc with a range of C, Si, Mn, and as a consequence a range of mechanical properties (ultimate, yield, impact strength and elongation given). A pad of filler metal was deposited from which the mechanical properties specimens and hard-surfacing samples were cut. A range of 0.05-0.14 C, 0.009-0.20 Si, 0.009-0.805 Mn was obtained in the deposited metal and impact strength taken as a measure of state of oxidation of the metal. Highest impact obtained where high C, Si, Mn, contents prevailed, therefore best deoxidizing conditions during deposition. Hard surfacing was accomplished by immersing the weld samples in a liquid hardening bath for six hours at 925° C. and box cooling. Micros are shown of the carburized surfaces, rated as to normality, coalescence, etc. The samples were water quenched from 900° C. and range of Rc hardness recorded. There was considerable difference for the various compositions, in the maximum deviation of hardness values, the higher the deviation the greater the heterogeneity of the deposited material and the less satisfactory the hardened case produced. The Mn content is considered principal criterion of satisfactory hardenability of deposited metal and when it is 0.40% or more the hardness is uniform, thick coating on arc welding rods are required for uniform surface hardening of the welds. Hard surfacing recommended as qualitative test of degree of oxidation of various parts of a weld. WB (7b)

**Multi-Layer Oxyacetylene Pipe Welding. Part I.** R. M. ROOKE & F. C. SAACKE. *Welding Journal, N. Y.,* Vol. 15, Oct. 1936, pages 2-7. **Part II.** ARTHUR N. KUGLER, pages 8-12. Part I. The advantages of newer multilayer welding are that longer lengths are welded than were previously, and metal first deposited is allowed to cool below critical thus obtaining full benefit of heat treatment by succeeding bead. Greater ductility and higher physicals are claimed due to reduced size of metal pool while welding time, gas and rod consumption are considerably reduced. Description is given of method of making multilayer pipe welds in steps with rolling machine rotating the pipe during welding. The angle of the weld bead is decreased as the number of layers is increased, thus necessitating melting less of the base metal and less rod to form the joint. The greater welding efficiency in gas consumption over single run welds is due to the first layer closing the root of the joint and preventing the gas flame from blowing out of opening at bottom thus after the first layer is down the heat of the flame goes more completely into the welding operation. Preparation of specimens for bend test by flame cutting is discussed and it is indicated that specimen flame-cut to size and sample flame-cut and machined have practically same bend properties therefor all tests reported are on flame-cut samples. Data are given for bend, impact, welding efficiency (time, gas consumption, rod consumption for 5/16"-7/8" material) for single and multilayer welds with the advantage on the side of multilayer welds in all cases. Part II. Results of field tests on welding installations performed according to method in Part I are given. Tensile, free bend, nick and break, reverse bend tests indicate good properties of joints made in service conditions, photos show some of the large piping joined by process. WB (7b)

**Modern Locomotive Boilers and Tenders Are Welded.** A. F. STIGLMEIER. *Industry and Welding,* Vol. 9, Oct. 1936, pages 26-32. Welded construction is shown to simplify manufacturing operations, reduce initial and maintenance costs and permit leak-proof operation. Some details of the welds are given showing how welds simplify design of former riveted structure. Rolled plate is welded to castings and plate is bent to shape and welded in for other parts of the boiler. Flues and tubes are welded to back tube sheet by a combination of torch and arc welding using Cu ferrules around the tubes. A new simplified technique is shown in which the tubes are inserted, flared and expanded and finally sealed into the sheet with single arc weld. All-welded oil and water tanks are being applied successfully. WB (7b)

**Welding Economies in Tugboat Construction.** EDGAR P. TRASK. *Welding Engineer,* Vol. 21, July 1936, pages 20-21. Data presented for comparison of welded 95-ft. tug as to weight, displacement, propelling machinery, etc., with older type of tug design. WB (7b)

**Stress Relieving Pipe-Joints by Induction Heaters.** C. M. WEINHEIMER. *The Welding Engineer,* Vol. 21, Oct. 1936, pages 38-39. Split ring collar for low frequency heating of pipe weld in place is discussed. Control of temperature rise and duration of stress relief temperature, cooling, etc., is either semi-automatic or fully automatic giving desired thermal cycle at will. WB (7b)

# 8. FINISHING

H. S. RAWDON, SECTION EDITOR

**Sale of Consumer Goods Affected by Type and Color of Finish Used.** *Steel,* Vol. 99, Nov. 2, 1936, pages 60, 79. According to results of interviews with department-store buyers to ascertain trend of consumer preferences in color finish, appearance outweighs almost every other consideration from point of view of merchandising. MS (8)

**Efficient Production Methods Reduce Cost of Finish on Cash Registers.** *Steel,* Vol. 99, Nov. 9, 1936, pages 60, 64, 74. Describes practice of National Cash Register Co., Dayton, O. Conveyor systems, cleaning, pickling, polishing, inspection, photoelectric conveyor control, degreasing, Ni plating, buffing, Cr plating and Cr buffing are described. MS (8)

**Highly Finished Tools Command Respect of Shop Mechanics.** *Steel,* Vol. 99, Nov. 16, 1936, pages 61, 82. Illustrates by several actual cases how finish affects attitude of workmen in their treatment of tools. MS (8)

## 8a. Pickling

**Waste Pickle Liquor Is Evaporated in Rubber-lined Steel Tank.** *Steel,* Vol. 99, Dec. 14, 1936, page 58. In large outdoor equipment consisting of rubber-lined welded steel tank sheathed with acid-resisting brick and equipped with steam coils to maintain a temperature of 210-220° F., the spent pickling liquor is held until completely evaporated. MS (8a)

**Etched Stainless Steel Furnishes Modern Medium for Skill of Artists and Craftsmen.** *Steel,* Vol. 99, Dec. 21, 1936, pages 48-49. Describes practice of C. H. Hanson Co., Chicago, in manufacture of serving ware. 18-8 stainless steel, rolled to standard No. 4 finish, 22-20 gage, is used. MS (8a)

## 8b. Cleaning including Sand Blasting

**New Fields of Application for Precision Surface Grinding.** CHAS. O. HERB. *Machinery, N. Y.,* Vol. 43, Oct. 1936, pages 97-101. Methods for grinding hardened steel parts and equipment and tools are described. Ha (8b)

**Cleaning Houses in the Wire Industry.** A. F. ANJESKEY. *Wire & Wire Products,* Vol. 11, Oct. 1936, pages 570-575, 603. Equipment, location, handling and storing of materials used in cleaning processes are described. Ha (8b)

**Hydraulic Descaling Valve Facilitates Removal of Tight Surface Scale.** *Steel,* Vol. 99, Oct. 26, 1936, page 74. Describes valve which is so constructed that $H_2O$ seal becomes tighter with increase in pressure. Special ports in valve body provide balanced pressure in valve continually. Body, of stainless steel, is only moving part in valve proper. It is operated by a specially mounted air cylinder, controlled in turn by a double solenoid specially constructed pilot-valve. MS (8b)

## 8c. Polishing & Grinding

**Polishing by Electrolysis (Polieren durch Electrolyse)** *Oberflächentechnik,* Vol. 14, Jan. 19, 1937, pages 15-16. The possibilities of electrolytic polishing are discussed. The method is based on the observation that, if a roughened Cu strip is immersed in a solution of 530 gm. $H_3PO_4$/l. water, and treated anodically within a certain voltage range it becomes bright and smooth. A suggested explanation of phenomenon is the possible formation of a poorly conducting solution of Cu phosphate in $H_3PO_4$ as a thin film in contact with the Cu. The elevated portions, constituting the roughness of the surface, project through this film and are dissolved until a smooth surface is obtained. Brass can be polished in a solution of 430 g. $H_3PO_4$/l. Pb can be polished in a mixture of 650-750 cc. glacial acetic acid and 250-350 gm. perchloric acid of 55° Bé at 20-25 amps./dm.$^2$, and Sn in a similar mixture at 15-17 amps./dm.$^2$ Ha (8c)

**Finishing Aluminum Hollow Ware.** *Steel,* Vol. 99, Dec. 28, 1936, pages 32-35. Describes some of the more important operations and equipment used in the grinding, machining, and polishing of cast Al ware at plant of Bremer Aluminum Co., New Washington, O. MS (8c)

## 8d. Electroplating

**Electroplating Technique and Surface Protection of Metal Wares (Galvanotechnik und Oberflächenschutz von Metallwaren)** A. WOGRINZ. *Berg- und Hüttenmännisches Jahrbuch,* Vol. 84, Aug. 28, 1936, pages 41-47. Historical development is reviewed, principles of electrodeposition of metals discussed and baths for cathodic and anodic processes described. The former comprise neutral and acid baths for Cr, Zn, Ni, Co, Cu, Sn and Pt metals, and alkaline baths for Zn, Cu, brass, bronze, Ag and Pt metals. The anodic process is at present restricted to the so-called "eloxal" treatment of Al and its alloys. The reactions occurring in plating baths, chemical compositions of the latter, materials for anodes and cathodes, current required for deposition of a given amount of metal, and the theories involved are discussed at length. Some general formulas are given, especially for continuous plating (galvanizing) of wires: $V = G/0.9d^2\pi S$, $L = GN/0.1fMC\pi d$, $I = NG/fM$, where V is the velocity of the wire in the bath in m./sec., G is the weight of wire in kg. to be finished per hr., N the weight of metal in kg. to be deposited on each kg. of wire, L the length of the wire in the bath in m., M the weight of metal deposited by 1 amp. in 1 hr. at 100% current yield, f the current yield in %, C the current density, and I the current in amp. Ha (8d)

**Electrolytic Gold Plating (Die galvanische Vergoldung)** *Oberflächentechnik,* Vol. 14, Jan. 5, 1937, pages 2-3. Au-plating of corrodible and non-corrodible materials is discussed. In general, very dilute electrolytes and low current densities can be employed; the throwing power of the Au baths is so good that pieces of very irregular shape receive a uniform deposit. For jewelry, a bath of 1.55 gm. Au cyanide, 2.35 g. NaCN and 1 l. $H_2O$ is recommended with 0.1 amp. current density, at 50°-60° C. Contacts of Al, brass, Cu or steel require an Au deposit of about 0.0127 mm. thickness, in a bath of higher concentration, e.g. 9.35 gm. Au cyanide, 14 g. NaCN and 1 l. $H_2O$. Parts should be degreased in trichlorethylene vapor or in a solution of 6 parts $H_2SO_4$ (sp. g. 1.84), 2 parts $HNO_3$ (sp. g. 1.42) and 3 parts $H_2O$. Suggestions for Au recovery from baths and solutions are given. Ha (8d)

**Portable Electroplating Apparatus Opens New Fields for Metal Coatings.** *Steel,* Vol. 99, Nov. 30, 1936, pages 48-49, 60. Describes equipment developed by Nickel and Chromium Products Co, consisting of current-supply unit, plating brush, anodes, electrolytes, and cleaning agents. Process which has many possible applications, is completely described. MS (8d)

**Effect of Chromium Plating on the Impact Strength of Steel.** F. F. VITMAN & J. B. SALITRA. *Zhurnal Tehnicheskoy Fiziki,* Vol. 6, 1936, pages 608-613. In Russian. The critical temperature for brittleness of chromium plated steel samples was sought. Propensity to brittleness is increased by Cr plating, the brittleness increasing with the thickness of deposit. Annealing of samples below $A_1$, reduced the embrittling effect of Cr plating. NA (8d)

**Tin-Plating. Its Use as a Substitute for Tinning Practice.** C. C. DOWNIE. *Electrician,* Vol. 117, Nov. 27, 1936, page 661. Development of electro-depositing Sn is traced. De-tinning processes are also discussed. CBJ (8d)

**An Electron-Diffraction Study of the Structure of Electro-Deposited Metals.** G. I. FINCH & C. H. SUN. *Transactions of the Faraday Society,* Vol. 32, June 1936, pages 852-863. The structure of the substratum upon which a metal is deposited nearly always determines that of the deposit. In a few cases where this effect does not occur, the deposit generally exhibits poor adhesion. When deposits are formed by chemical displacement instead of electro-deposition, the formation of alloys occurs. 11 references. PRK (8d)

**The pH of Electroplating Solutions.** RICHARD SPRINGER. *Metal Industry,* New York, Vol. 34, Dec. 1936, pages 473-476. Significance of pH number is explained and its application to electroplating solutions is pointed out. See *Metals and Alloys,* Vol. 7, Dec. 1936, page MA 594L/8. CBJ (8d) 1

## 8e. Metallic Coatings other than Electroplating

**A Comparison of Galvanising Processes.** RICHARD SAXTON. *Mechanical World & Engineering Record,* Vol. 99, Mar. 13, 1936, pages 269-272. The hot dip process, sherardising, spraying and electro-deposition are compared. WH (8e) 2

**Spraying of Molten Metal.** L. E. KUNKLER. *Mechanical Engineering,* Vol. 58, Oct. 1936, pages 639-640. The mechanics of metallizing, i.e. the spraying of motlen metal on any metallic or nonmetallic surface without the use of a flux and without preheating the object to be coated, is discussed. This process is superior to welding for building up worn machine parts as no preheating is required, overheating is impossible and no internal stresses are set up. Average bond strength of various metals tested was 700 lb./in.$^2$ The approximate scleroscope hardnes sof sprayed metals was found to be 18 for bronze, 26 for P-bronze and for 0.10% C steel, 40 for 0.40% C steel, 60 for 0.80% C steel, 75 for 1.20% C steel, 45-70 for stainless steel according to composition. Several examples of metal spraying jobs and equipment are described. See *Metals and Alloys,* Vol. 7, Nov. 1936, page MA 538R/8. Ha (8e) 3

**Adhesion of Galvanized Coatings on Steel Wire.** E. H. LYONS, JR. *Wire & Wire Products,* Vol. 11, Nov. 1936, pages 655-656, 674. The relative advantages of electrolytic coatings on Zn wire, by virtue of the much sharper zone of bonding between Zn and the steel, than is obtained in hot-galvanizing are discussed and the Meaker process by which brilliant, dense, non-porous deposits are obtained at current densities up to 1500 amp./ft.$^2$ is described. A further advantage claimed is that very heavy coatings, 3 times heavier than in best hot-galvanizing methods, can be deposited. Ha (8e) 4

**Metal Spraying; a Comparison with Other Methods of Surface Protection (Das Metallspritzen; Vergleich mit anderen Verfahren der Oberflächenveredelung)** G. SCHENK. *Z. Ver. deut. Ing.,* Vol. 80, Sept. 26, 1936, pages 1189-1192. General discussion. Spray guns with 18 Kg. metal/hr. capacity are now available. 10 references. Ha (8e) 5

**Production of Galvanized Sheet Ware (Herstellung verzinkter Blechwaren)** E. SIEBEL. *Stahl und Eisen,* Vol. 56, Nov. 19, 1936, pages 1382-1385. Production of galvanized pails and sheet roofing is described. By drying the ware after pickling, before galvanizing, a saving in Zn of 20 to 25% was effected. SE (8e) 1

**Current Practices in Wire Galvanizing as They Affect Ductility and Other Properties.** C. W. MEYERS. *Steel,* Vol. 99, Oct. 12, 1936, pages 78, 80, 107; Oct. 19, 1936, pages 50-52. Paper read before Edison Electric Institute in Detroit. Outlines zinc plating and hot galvanizing processes, and discusses, with aid of micrographs and macrographs, effect of various practices on failure of Zn coatings. MS (8e) 2

**Temperature and the Galvanizing Furnace.** W. G. IMHOFF. *American Machinist,* Vol. 80, Dec. 30, 1936, pages 1077-1078. For maximum pot life, 870° F. should not be exceeded. Ha (8e)

## 8f. Non-Metallic Coatings

**New Bonderizing Process for Zinc Surfaces.** *Iron Age,* Vol. 138, July 16, 1936, pages 56-57. New process developed by Parker Rust-Proof Co., Detroit, for producing an insoluble phosphate coating on the surfaces of Zn and Zn alloys is particularly suitable for the treatment of Zn-base die castings, galvanized parts or Galvannealed metal which is subsequently painted or lacquered. VSP (8f) 3

**Vitreous Enamel Applied to Copper.** *Steel,* Vol. 99, Sept. 21, 1936, page 56. Describes development by Battelle Memorial Institute of several types of enamels especially adapted for use with Cu. MS (8f) 4

**Natural Patina Applied to Copper in Field by Novel Electrolytic Process.** *Steel,* Vol. 99, July 27, 1936, page 42. Describes method developed by Battelle Memorial Institute. See *Metals and Alloys,* Vol. 6, July 1935, page MA 289R/4. MS (8f) 5

**Wood Veneer Opens New Architectural Uses for Steel.** *Steel,* Vol. 99, Sept. 14, 1936, pages 62, 64. "Flexwood," manufactured by United States Plywood Co., is a wood veneer about 0.012 in. thick mounted on cotton sheeting by means of a $H_2O$-resistant adhesive, and applied by hand to any flat or curved smooth, hard surface, including steel, by using a special, elastic, high-strength, $H_2O$ resistant adhesive. Examples of its application to metals are railroad cars, elevator cabs, radiator inclosures, desks, compacts, cigarette cases, and lamps. MS (8f) 6

**Determination of Physico-Chemical Conditions Affecting Adhesion of Vitreous Enamel to Metals.** E. A. KHVASS. *Liteinoe Delo,* Vol. 7, No. 7, 1936, pages 39-42. In Russian. Good summary of latest work on the subject taken mostly from German sources. (8f) 7

**Study on the Hardness of the Alumina Film obtained by the Anodic Oxidation (Etude sur la dureté des pellicules d'alumine obtennés par oxydation anodique)** ANDRE HACHE. *Métaux,* Vol. 11, May 1936, pages 116-117. The hardness of the $Al_2O_3$ film decreases rapidly with temperature and with the increase in acid concentration. Hardness depends on the thickness of the film and for low temperatures and small concentration, this hardness increases with the number of coulombs. GTM (8f) 8

**Enamel Coatings in Theory and Practice (Die Emailüberzüge in Theorie und Praxis)** J. PERMANN. *Berg- und Hüttenmännisches Jahrbuch,* Vol. 84, Aug. 28, 1936, pages 77-82. The conditions which assure a good and firmly adhering enamel coating on metals are discussed. The usual process is first to coat the metal with an enamel or vitreous material to which is added a flux consisting of different metal oxides which form an intimate bond with the metal, and on this ground layer to put the actual enamel layer which has the properties required in each individual case. The best oxides in the ground coat for producing the best adhesion are CoO, NiO and $MnO_2$. The Fe oxides on the metal to be coated are soluble in the ground enamel and form an intimate bond in melting. A composition recommended for cast Fe which is to be enameled is 3-3.5% C, 2-2.6% Si, 0.3-0.6% Mn, 0.7-2.0% P, 0.07-0.2% S; and for steel sheets: 0.06-0.08% C, 0.05-0.1% Si, 0.08-0.4% Mn, less than 0.1% P and less than 0.05% S. Methods for testing the resistance of enamels against chemical action are described. The protection of an enamel layer against chemical action is better the thinner the layer can be made. Acetic acid has a max. attacking effect on enamel at 20% concentration, while on steel it increases with concentration. Fields of application of enameled wares are discussed. 6 references. Ha (8f) 9 10

# 9. TESTING

**Complex Methods for Study of Metallic Alloys (Méthodes Complexes pour l'Étude des Alliages Métalliques)** LEON DLOUGATCH. *Revue de Métallurgie,* Vol. 33, Oct. 1936, pages 612-618. The stresses to which metals are subjected in service are always complex, so that besides the main stresses supplementary phenomena have to be accounted for. In order to predict the behavior of a metal in service, tests should be run covering all properties which might be affected by these related phenomena, instead of studying only one property at a time. The results should then be studied in the light of data furnished by the whole series.
JDG (9)

## 9a. Inspection & Defects, including X-Ray Inspection

C. S. BARRETT, SECTION EDITOR

**Macroscopic and Macrographic Tests of Metals (Sur les Épreuves Macroscopiques et Macrographiques des Métaux)** M. P. REGNAULD. *Memorial de l'Artillerie Francaise,* Vol. 14, No. 3, 1935, pages 599-631. Subcommittee report of the committee for "Test Methods of Ferrous Products" of L'Association Francaise de Normalisation. Methods of testing are classified as follows: (1) impression with Ag salt, (Baumann prints); (2) iodine etching; (3) and (3a) Cu chloride etching; (4) rapid etching with HCl; (5) slow etching with HCl or $H_2SO_4$. Details of the methods are described and results discussed. Deep acid etching (method 5) is conducted at room temperature instead of at the "simmering" point of the solution as is customary in this country. Time of etching is from 8 hrs. (in 15% $H_2SO_4$) to 18 hrs. (in 1:2 HCl). Compositions of reagents for Cu alloys and Al alloys are given and methods of application described. Macrographic tests are recommended as essential complements to mechanical tests in specifications. (Translation by O'Halloran and Reed, Report 131/5 is available at Watertown Arsenal, Mass.) DJM (9a)

**Problems of Internal Physics of Materials (Problèmes de Physique Interne des Matériaux)** GEORGES A. HOMES. *Revue de Métallurgie,* Vol. 33, Oct. 1936, pages 641-645. Recommends application of X-rays to the study of metals. JDG (9a)

**Details of X-ray Apparatus.** ROBERT C. WOODS. *Iron Age,* Vol. 138, Oct. 22, 1936, pages 36-41. Gives some fundamental data concerning X-ray operation and equipment, to assist prospective purchasers of such apparatus. VSP (9a)

## 9b. Physical & Mechanical Testing

W. A. TUCKER, SECTION EDITOR

**Indentation Hardness Testing—Definition of Hardness—Commonly Used Hardness Testers—Conversion of Hardness Numbers.** VINCENT. E. LYSAGHT. *Canadian Chemistry & Metallurgy,* Vol. 20, Dec. 1936, pages 380-382, 384. Indentation hardness is regarded as resistance to permanent deformation. A review of hardness testing by such instruments as the Brinell, the scleroscope, the Rockwell, the Vickers and Monotron testers is made. WHB (9b)

**The Impact Testing of Cast Iron.** J. W. DONALDSON. *Foundry Trade Journal,* Vol. 55, Sept. 3, 1936, pages 175-178. Cast Fe is not used commonly to resist impact or shock, but the development of high-duty and alloy cast irons and their application during recent years to parts subjected to such conditions have led to a number of investigations to determine what impact resistance the various types of cast Fe possess. The most widely used impact testing machines are the Izod and Charpy. The object of notching, types of tests used, single-blow machines, A.S.T.M. investigations, elevated temperature tests, influence of alloy additions, superiority of Mo-Fe and correlation of results are discussed by the author. AIK (9b)


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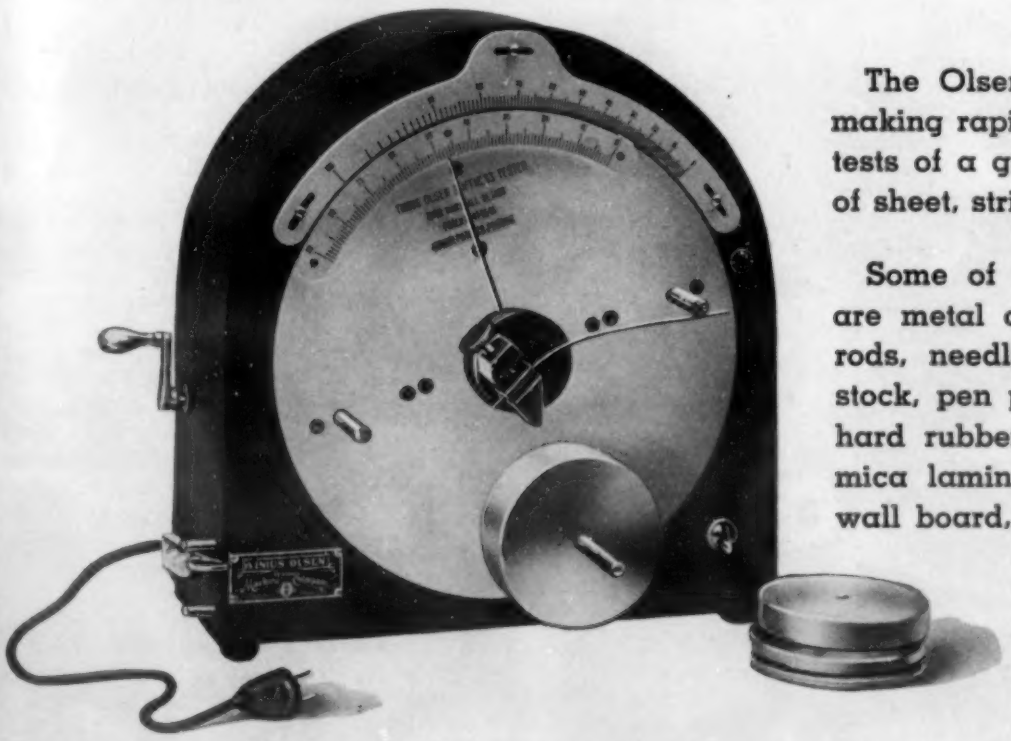

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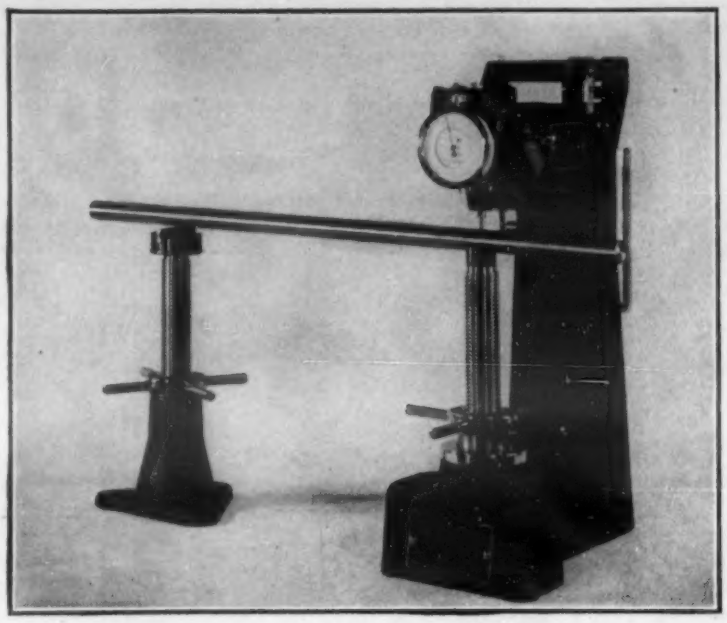

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**The Problem of Upper and Lower Yield Points and the Tensile Strength (Zur Frage der oberen und unteren Streckgrenze und der Zerreisslast)** G. WELTER. *Metallwirtschaft,* Vol. 15, Sept. 18, 1936, pages 885-889; Oct. 2, pages 936-938. According to the method of loading, tensile machines are classified as those using: (a) a rigidly restrained load, (b) an elastically restrained load, and (c) a free, unrestrained load, and it is shown that fundamentally different records are obtained from each type. By means of an artificial device upper and lower yield points were measured on the different machines under different experimental rates. These experiments led to the conclusion that the upper yield point is not conditioned by the material, but rather by the method of measurement. Welter also questions the drop in load before fracture, and shows that it too is affected by the type of machine. **A Contribution Concerning Tensile Tests with Directly Applied Weights (Beitrag zur Frage des Zugversuches mit reiner Gewichtsbelastung)** E. O. BERNHARDT. *Metallwirtschaft,* Vol. 15, Sept. 18, 1936, pages 889-892. A criticism of the foregoing paper. Experiment shows that the irregularities at the yield point in most stress-strain curves are not obtained with a directly applied, steadily increasing load. The irregularities cannot be explained by an actual decrease in load caused by acceleration of the measuring equipment, but are due instead to an increased rate of deformation. Therefore tensile tests made by direct application of weights are actually dynamic tests and the method is of questionable value. In reply, Welter questions Bernhardt's conclusions and shows that with directly applied weights there is never an instantaneous elongation of the specimen, therefore this must be considered as a static test. See also *Metals and Alloys,* Vol. 7, Apr. 1936, page MA 198R/4. GD (9b)

**Electrical Measurement and Control of Temperature (Elektrisches Messen und Regeln der Temperatur)** H.-O. MEYER. *Elektrotechnische Zeitschrift,* Vol. 57, Dec. 3, 1936, pages 1417-1420. Principles and apparatus described. Ha (9b)

**The National Physical Laboratory.** *Engineering,* Vol. 142, Nov. 13, 1936, pages 523-525; Nov. 27, 1936, pages 576-578. Summary of the sections of the Annual Report of the National Physical Laboratory dealing with X-ray analysis of metals and testing of welded joints. LFM (9b)

1 **Improved Method of Testing Cast Iron.** *Foundry Trade Journal,* Vol. 55, Aug. 27, 1936, pages 162-163. The transverse test is employed far too seldom in foundries, although it is simpler and less expensive than tensile test, and, when it includes deflection figures, provides a better characterization of cast Fe than the tensile test. The divergent values inevitable when measuring the deflection of standard bars, such as those now in common use, will be considerably reduced, by adapting the diameter of the bar to the wall thickness of the castings. The author designed a simple and inexpensive testing machine, the applicability of which is so far confined to a test bar of 10 mm. diameter, as this range is adequate to meet the needs of the majority 2 of foundries. With this machine rapidly prepared samples are tested while the melt is held, without having to wait for the result obtained by the laboratory. In the majority of cases, the test bars need not be molded and cast separately; the runners and risers can be used. AIK (9b)

**The Behavior of a Brittle Material at Failure.** M. M. FROCHT. *Journal of Applied Mechanics,* Vol. 3, Sept. 1936, pages A99-A103. Some unusual fractures are reported from experiments 3 which show that the strength of bakelite, a typically brittle material, is determined by the maximum tensile stresses as computed by advanced methods of stress analysis. 10 references. Ha (9b)

**Table Type Metallographic Microscope.** H. FREUND. *Engineering Progress,* Vol. 17, Sept. 1936, page 212. Describes a new microscope with camera for magnifications from 25 to 1000 times. Ha (9b)

4 **Photo-thermometry (Die Photo-Thermometrie)** K. HENCKY & P. NEUBERT. *Archiv für technisches Messen,* No. 62, Aug. 1936, pages T100-T101. Photo-thermometry utilizes, for the determination of surface temperatures, the effect of infra-red rays emitted by the heated surface on sensitized photographic plates. Equipment available, and calibration and evaluation of blackened plates are described. Photo-thermometric accuracy is ± .05%; conventional photometric accuracy is ±1%. Ha (9b)

5 **Hardness Testing Instruments (Ueber Härteprüfgeräte)** H. SCHULZE-MANITIUS. *Messtechnik,* Vol. 12, Sept. 1936, pages 183-187; Oct. 1936, pages 201-204. Review of principles and methods of hardness testing. Ha (9b)

## 9c. Fatigue Testing

H. F. MOORE, SECTION EDITOR

6 *The abstracts appearing under this heading are prepared in cooperation with the A.S.T.M. Research Committee on Fatigue of Metals. The purpose of this cooperation is to make readily available complete references to the literature on this subject. The Committee does not necessarily subscribe to the statement of either the author or the abstractor.*

**Behavior of Steel at Elevated Temperatures under Alternating Tensile Stresses (Verhalten des Stahles bei höheren Temperaturen unter wechselnder Zugbeanspruchung)** M. HEMPEL & 7 H. E. TILLMANNS. *Mitteilungen aus dem Kaiser-Wilhelm-Institut für Eisenforschung, Düsseldorf,* Vol. 18, No. 12, 1936, pages 163-182. In critically reviewing the literature of fatigue strength at elevated temperatures, it is noted that "creep" under alternating load has been generally ignored. Methods and instruments for determining "creep" strength under alternating stresses and experiments with a C, a Mo, and a Cr-Ni-W steel are described. The 0.02 and 0.2 limit, "creep" strength, and the tensile strength 8 up to 600° C. were determined. In general, the "creep" curves show the same rate of elongation as the curves for steadily increasing load if the upper load limit in the alternating test is the same as the constant value in the static test. Elongation under gradually increasing load depends on the upper load limit and in the ranges and for the materials investigated, no frequency effect exists. 32 references. Ha (9c)

## 9d. Magnetic Testing

9 L. S. REID, SECTION EDITOR

**Sperry Method for Investigation of Internal Defects in Rails (La Méthode Sperry pour la Récherche des Défauts Internes des Rails)** N. METCHERSKY. *Revue de Métallurgie,* Vol. 33, Dec. 1936, pages 747-755. Sperry detector car, introduced in Europe in 1932, is generally accepted as a reliable indicator of condition of track. It was thought originally that fewer transverse fissures are 10 to be expected in Europe than in the U. S. A. because the loads on wheels are much lighter. Actually it was found that on heavier rails of S-33 type transverse fissures were found at the rate of about 1 per 45 km. of track, but on lighter rails they were present at the rate of 2 per kilometer. JDG (9d)

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# 10. METALLOGRAPHY

J. S. MARSH, SECTION EDITOR

**X-Ray Methods for Ternary Systems.** A. G. H. ANDERSEN & ERIC R. JETTE. *Transactions American Society for Metals,* Vol. 24, Sept. 1936, pages 519-540. Detailed discussion of X-ray methods applicable to the study of ternary alloy systems as employed in the author's recent study of Fe-Cr-Si alloys. See *Transactions American Society for Metals,* Vol. 24, June 1936, page 375, also *Metals and Alloys,* Vol. 7, Dec. 1936, page MA 600R/6. 9 references. WLC (10)

**Intermetallic Compounds and Phases of Variable Composition in the Ultra-light Bimetals.** V. A. BOBROV. *Izvestia Sektora Fiziko-Khimicheskogo Analiza,* Vol. 9, 1936, pages 99-127. Bimetals are best formed by hot rolling. Properties of pairs such as elektron-Al depend on the amount of $Al_3Mg_4$ and of other phases formed at the interface. Conditions for control of these factors are given. NA (10)

**The Crystal Structure of Polonium by Electron Diffraction.** M. A. ROLLIER. *Journal of Chemical Physics,* Vol. 4, Oct. 1936, pages 648-652. Diffraction patterns were obtained from Po and compared with those from Bi and Te. The structure of Po closely resembles that of Te, the lattice being pseudo-hexagonal with a = 4.25 A.U., c = 7.06 A.U. or 14.12 A.U. and the calculated density 9.39. FPP (10)

**On the Possibility of a Metallic Modification of Hydrogen.** E. WIGNER & H. B. HUNTINGTON. *Journal of Chemical Physics,* Vol. 3, Dec. 1935, pages 764-770. Theoretical calculation of the lattice constants of "metallic" H (having a lattice in which the atoms would be translationally identical) is presented as an exploration of the possibility of preparing metallic H under high pressures. The energy of a body-centered H lattice is calculated as a function of the lattice constant. Body centered modifications (metallic) cannot be obtained with present pressures, nor can other simple metallic lattices, although a bare possibility exists of obtaining intermediate, layer-like lattices, such as those of graphite, black P, etc. FPP (10)

**Determination of Slag Inclusions in Steel.** YU. T. LUKASHEVICH-DUVANOVA. *Metallurg,* Vol. 11, May 1936, pages 19-33. In Russian. Electrolytic method of Treje and Benedicks using 0.1*N* KBr and 10% Na citrate together with $CuSO_4$ was compared with Fitterer's method. The former obtains all inclusions including MnS, the latter does not. A general survey of the conditions required for accurate determination of non-metallic inclusions is made. (10)

**The Structure of Steel.** *Edgar Allen News,* Vol. 15, Oct. 1936, pages 923-924. Preparation of etched sections to show cementite, martensite, austenite, troostite and pearlite is described and photomicrographs are shown. Ha (10)

**The Diffraction of Electrons by Amalgam Films.** A. E. AYLMER, G. I. FINCH & S. FORDHAM. *Transactions of the Faraday Society,* Vol. 32, June 1936, pages 864-871. Experiments were carried out to study the structure of thin Au, Ag, Cu, and Pd foils after attack by Hg under conditions representative of adventitious contamination of such films in the laboratory. Fine Au leaf, after thinning by floating in KCN solution, gave characteristic diffraction patterns of the pure metal and in addition two extra lines corresponding to spacings 4.44 and 2.56 A.U. These extra lines were due to traces of amalgam. Amalgamation of Pd may suffice to bring into evidence impurities otherwise too small in amount to affect the main diffraction pattern. Au and Ag and possibly many other metals are prone to amalgamation in an electron-diffraction camera evacuated by a Hg-vapor pump. With Au the first signs of amalgamation occur in about one hour. Au and Ag both form sinmple cubic amalgams a = 17.81 and 17.94 A.U. respectively. Two other face-centered tetragonal amalgams have been recognized. The structure of the most characteristic amalgam formed with Cu has not been identified. Pd is only partially attacked by Hg. 11 references. PRK (10)

**The Nature of the Solid Solution of Antimony in Lead.** N. W. AGEEW & I. W. KROTOV. *Journal Institute of Metals,* Vol. 59, Sept. 1936, pages 493-500 (Advance Copy No. 748). X-ray analysis and density determinations indicate that the solid solution of Sb in Pb is of the simple monatomic type. Thermodynamic analysis is not in contradiction to this if errors of the order of 2° C. are assumed to exist in the equilibrium diagram. JLG (10)

**Effect of Titanium on Aluminum Alloys.** HIDEO NISHIMURA & NOBUO KAGIWADA. *Suiyokwai-Shi,* Vol. 9, Nov. 1936, pages 95-98. In Japanese. It is well known that a very fine structure in cast material can be obtained by the addition of a small quantity of Ti to some Al alloys. The authors prove also the grain refinement due to Ti in Al-Cu alloys. From the investigation of the Al-Cu-Ti diagram, it was found that a peritectic reaction, liquid + $TiAl_3$ ⇄ Al, occurs immediately after the primary separation of Al or $TiAl_3$. They conclude that grain refinement by Ti in Al-Cu alloys is produced by this phenomenon. HN (10)

**Alloys of Magnesium. Part IV.—The Constitution of the Magnesium-rich Alloys of Magnesium and Silver.** R. J. M. PAYNE & J. L. HAUGHTON. *Journal Institute of Metals,* Vol. 60, Oct. 1936, pages 557-562 (Advance Copy No. 753). The form of the liquidus and the values obtained for the eutectic and peritectic temperatures by other workers have been checked in Mg-Ag alloys containing up to 60% Ag. Solid Mg can hold up to 15% Ag in solution at the eutectic temperature, but less than 1% at 200° C. The alloys should be capable of precipitation hardening. 7 references. See *Metals and Alloys,* Vol. 7, Jan. 1936, page MA 28L/8. JLG (10)

**Morphology of the Inclusions in Siderurgical Products. Part III.—Chromium Alloys and Chromium Steels.** A. M. PORTEVIN & RENÉ CASTRO. *Iron & Steel Institute,* Advance Copy No. 13, Sept. 1936, 27 pages. Describes microstructures of non-metallic inclusions formed in the presence of O, Si, S, Mn, and Al. 78 micrographs are shown, and each is discussed. The effect of the various types of inclusions on the polishing of Fe-Cr alloys is discussed. See *Metals and Alloys,* Vol. 7, Mar. 1936, page MA 144L/3. JLG (10)

**On the Theory of Equilibrium in Alloys. I.** WM. HUME-ROTHERY. *London, Edinburgh, and Dublin Philosophical Magazine & Journal of Science,* Vol. 22, Supplement Nov. 1936, pages 1013-1047. The effect of lattice distortion on the solid solubility limits in binary alloys was investigated and the results are given in diagrams. It seems possible that there is more justification for considering atomic percentage compositions in the solid state than in the liquid state. 24 references. Ha (10)

**The Solubility of Silver and Gold in Solid Magnesium.** WILLIAM HUME-ROTHERY & EWART BUTCHERS. *Journal Institute of Metals,* Vol. 60, Oct. 1936, pages 551-556. (Advance Copy No. 752). The solidus and solid solubility limits above 300° C. of Mg-rich Mg-Ag alloys were determined microscopically. At the eutectic temperature (471° C.) the solubility of Ag in Mg is 15.3% and the solubility decreases with decreasing temperature to 3.9% at 300° C. The maximum solubility of Au in solid Mg is in the order of 0.1% at 576° C. and the solubility decreases with decreasing temperature. JLG (10)

**Theoretical Study of Diffusion in Solids (Étude Théorique de la Diffusion des Solides)** JEAN CICHOCKI. *Journal de Physique et le Radium,* Vol. 7, Oct. 1936, pages 420-426. The mutual diffusion of 2 metals in contact is considered mathematically, based on the assumption that the plane of separation is replaced by an alloy of the 2 metals. The composition and the rate of advance of the alloy into the 2 metals depends on the ratio of the diffusion constants of the 2 metals. Thus the ratio of the diffusion constants of Au in Pb and of Pb in Au is about $10^{38}$ at 285° C. Applying the laws of probability, equations are derived for calculating the numerical value of the mutual diffusion constant for 2 metals and the degree of error involved. FPP (10)

**Methods for the Examination of Thermal Effects Due to Order-disorder Transformations.** C. SYKES & F. W. JONES. *Journal Institute of Metals,* Vol. 59, Sept. 1936, pages 469-492 (Advance Copy No. 747). An experimental arrangement is described whereby quantitative investigation of order-disorder transformations can be made. The equipment allows the heat absorption of the specimen to be determined as the temperature is constantly varied and specific heat-temperature curves may be obtained which contain the effects due to transformation superimposed on the normal heat-temperature curves. Various manifestations of the transformation in $Cu_3Au$ are used in the paper as illustrations of the type of results that can be obtained. Their relation to the various theories of atomic rearrangement will be discussed in a subsequent publication. 8 references. JLG (10)

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Metallography in Service of Technology (Die Metallographie im Dienst der Technik) HUGO BECKER. *Emailwaren-Industrie,* Vol. 13, Sept. 3, 1936, pages 291-293. RAW (10)

6 A **Simple Approximate Method for Determining Nodule Number.** H. A. SCHWARTZ. *Metals and Alloys,* Vol. 7, Nov. 1936, page 278. Graphical approximation for the relation between nodules/unit irea and unit volume are shown. WLC (10)

7 **Influence of Grain Size on the Mechanical Properties of Extra Pure Magnesium (De l'influence de la grosseur du grain sur les propriétès mécaniques du magnésium extra pur)** JEAN HERENGUEL & PAUL LACOMBE. *Métaux,* Vol. 11, Sept. 1936, pages 185-186. Pure Mg subjected to a 15% cold reduction and annealed at 250 deg. C. becomes fine grained. In the range of 200 to 8000 grains per mm.$^2$, the elongation and tensile strength vary linearly with the logarithm of the number of the grains. GTM (10)

8 **Some Observation on Flakes.** GEORGES ROBERT DELBART. *Metal Progress,* Vol. 30, Nov. 1936, pages 53-54. Flakes do not occur with the same frequency or dimensions in various steels. Steels of a stepped cooling curve or suppressed transformation are more susceptible to flakes than others. Ni-Cr and C steels are among those less susceptible. A steel C 0.15%, Mo 0.30%, Cr 0.35-60% shows less tendency to flakes when made in the acid furnace than when made in the basic furnace. Flakes are shown that are similar to segregation defects. Flakes may have an internal dendritic pattern. WLC (10)

9 **Representation of a Multicomponent System by Spiral Coordinates.** V. J. ANOSOV. *Izvestia Sektora Fiziko-Khimicheskogo Analiza,* Vol. 9, 1936, pages 5-25. In Russian. An example indicates the application of this method of representation to metallic systems. Na (10)

10 **The Symmetry and Crystal Structure of the Minerals of the Arsenopyrite Group.** M. J. BUERGER. *Zeitschrift für Kristallographie,* Vol. 95, Oct. 1936, pages 83-113. In English. An extended study leading to the correct crystal structure of arsenopyrite (FeAsS) and the arsenopyrite groups of crystals. Exceptional difficulties prevent the usually easy crystal-structure approach. EF (10)

**The Non-diffusion Transformation of the $\beta$-Phase in Copper-zinc Alloys (Ueber die diffusionslose Umwandlung der $\beta$-Phase der Kupfer-Zink-Legierungen)** E. KAMINSKI & G. KURDJUMOW. *Metallwirtschaft,* Vol. 15, Sept. 25, 1936, pages 905-907. Reasoning from the similarity of the Cu-Zn and Cu-Al diagrams, a martensite-like transformation, i.e., transformation without diffusion, is to be expected in the $\beta$ region of the Cu-Zn alloys, probably below room temperature. Alloys containing from 40 to 44 weight % Zn were quenched in water to room temperature, then cooling curves were made down to liquid air temperature. An alloy near the $\alpha$ limit showed repeatedly a heat evolution at —14° C. When this alloy was quenched in a caustic solution, the X-ray photogram showed a new set of lines corresponding to an ordered face-centered tetragonal lattice with $a = 3.755$ A.U., $c = 3.586$ A.U. which is called the $\alpha'$ phase. Alloys up to the $\alpha$ region showed $\alpha'$ after this treatment. Assuming that the unordered $\beta$ lattice transforms first to the ordered $\beta'$, and then to $\alpha'$ by the same crystallographic process as $\gamma$ to $\alpha$Fe, it can be supposed that the $\alpha'$ lattice has Cu atoms at the corners and face centers of the top and bottom of the unit cell, with Zn atoms at the face centers of the four sides. GD (10)

**Thermal Investigation of Chemical Compounds in the System Zinc-magnesium.** M. I. ZAHAROVA & A. B. MLADZEEVSKIY. *Izvestia Sektora Fiziko-Khimicheskogo Analiza,* Vol. 9, 1936, pages 193-202. In Russian. Time-temperature curve (heating) for the compound $MgZn_5$ shows 2 critical points, one at 367° and the other at 379°; first is eutectic point and second is peritectic ($MgZn_2 + Liq. = MgZn_5$). Na (10)

**Cation Arrangement in a Few Oxides with Crystal Structures of the Spinel Type.** E. J. W. VERWEY & J. H. DE BOER. *Recueil des Travaux Chimiques des Pays-Bas,* Vol. 55, June 15, 1936, pages 531-540. In English. Summary in German. Based on X-ray measurements it is concluded that $Fe_3O_4$ is built up on bi- and trivalent ions but $Co_3O_4$ and $Mn_3O_4$ on bi- and quadrivalent ions. The latter are regular spinel lattices. EF (10)

**Study of Liquid Eutectic Alloys.** N. V. GEVELING. *Izvestia Sektora Fiziko-Khimicheskogo Analiza,* Vol. 9, 1936, pages 63-83. In Russian. Investigation of the systems Cd-Bi and Cd-Sn indicated the existence of eutectic association in the liquid state. NA (10)

**Properties of Metallic Solutions. Communication I.** W. K. SSEMETCHENKO. *Acta Physicochimica USSR,* Vol. 4, No. 5, 1936, pages 695-704. In English. The similarity between the structures (X-ray) of the liquid and solid metals suggests a similarity between the relationships existing in liquid and solid metallic solutions and the possibility of extending the theory of the solid state with certain modifications to the liquid metals. A systematic research on the properties of metallic solutions was started concentrating on surface phenomena, mutual solubility of metals, influence of impurities thereon and effect of impurities on surface tension and crystallization. Concludes with a critical discussion on technologic problems viewed from the standpoint of the conception of surface-active metals (modifying effect of alkali and alkaline-earth metals in Al-Si alloys, growth of metallic crystal faces, mutual solubility of 2 metals, catalytic action). EF (10)

**The Desulphurization of Iron by Hydrogen (Ueber die Entschwefelung von Eisen durch Wasserstoff)** W. BAUKLOH. *Metallwirtschaft,* Vol. 15, Dec. 11, 1936, pages 1193-1196. Desulphurizing experiments on Fe-S and Fe-S-Mn alloys show that the rate of diffusion of H rather than the chemical reaction between H and sulphide controls the desulphurizing process. % sulphurization-*vs.*-temperature curves show for Fe-S alloys a break at 900° C. corresponding to the $\alpha\gamma$ transformation. Adding Mn causes the break to occur at lower temperatures, indicating a drop in the temperature of the $\alpha\gamma$ transformation. GA (10)

**Intermetallic Phases of Variable Composition.** N. W. AGEEW. *Izvestia Sektora Fiziko-Khimicheskogo Analiza,* Vol. 8, 1936, pages 175-200. In Russian. Discussion of solid solutions and intermetallic compounds. 66 references. NA (10)

**X-ray Analysis of Manganese-rich Manganese-silicon Alloys. (Röntgenanalyse manganreicher Mangan-Silicium-Legierungen)** K. AMARK B. BOREN & A. WESTGREN. *Metallwirtschaft,* Sept. 4, 1936, pages 835-836. Alloys containing 10, 14, and 27% at. % Si were prepared from high-purity material and powder samples were quenched from 1000°, 800°, and 600° C. In the samples quenched from the two low temperatures several phases of very low symmetry were observed, no attempt being made to determine their structure. The questionable existence of the cubic phase $Mn_3Si$ as well as that of hexagonal $Mn_5Si_3$ were both substantiated, the structure of the latter being determined as $D^3_{6h}$. GD (10)

**X-ray Stress Observations on Iron-nickel Sheet (Röntgenographische Spannungsbeobachtungen an Nickel-Eisenblech)** W. G. BURGERS & F. M. JACOBS. *Metallwirtschaft,* Vol. 15, Nov. 6, 1936, pages 1063-1066. By means of back-reflection photograms the authors show that for a recrystallized sheet containing 53 at. % Fe, the (400) interference ring from CoK$\alpha$ X-rays is very sensitive to change of lattice constant. Use of this knowledge was made in investigating the state of stress of this material, as processed, in an endeavor to correlate internal stress with magnetic behavior. No conclusions were reached. Quenching stresses were also investigated. Drawn Ni-Fe wire of the above composition showed a recrystallization texture such that the [100] direction lies parallel to the wire axis. GA (10)

**An Apparatus for Optical Demonstration of some Geometrical Features of Electron Diffraction Photographs.** W. G. BURGERS & J. J. A. PLOOS VAN AMSTEL. *Zeitschrift für Kristallographie,* Vol. 95, Oct. 1936, pages 54-73. In English. An "optical" demonstration apparatus, suitable for large-scale explanation of the principle and application of the reciprocal lattice, has been developed. The following examples are discussed at length: (1) "Laue" photograph of an aggregate of crystallites scattered about a definite position, (2) diffraction photographs of an arrangement of hexagonal crystallites with [0001] as common fibre axis, (3) photograph due to "intramolecular diffraction." EF (10)

**A Technique for the Construction of Models Illustrating the Arrangement and Packing of Atoms in Crystals.** M. J. BUERGER & ROBERT D. BUTLER. *The American Mineralogist,* Vol. 21, Mar. 1936, pages 150-172. The authors believe that "a neat, strong, packing model of any crystal structure can be made by their method no matter how complicated the structure provided that time and labor spent on calculation and construction are worth the effort." The principles underlying the method are fully considered and 2 examples calculated through. EF (10)

**Crystal Structure of $Mg_2Zn_{11}$ and Its Isomorphism with $Mg_3Cu_7Al_{10}$ (Zur Kristallstruktur von $Mg_2Zn_{11}$ und dessen Isomorphie mit $Mg_3Cu_7Al_{10}$)** F. LAVES & ST. WERNER. *Zeitschrift für Kristallographie,* Vol. 95, Oct. 1936, pages 114-128. X-ray and chemico-analytic investigations proved that the Zn-rich Mg-Zn compound, previously considered to be $MgZn_5$, is better represented by the formula $Mg_2Zn_{11}$. This intermetallic compound is cubic, Laue symmetry = $O_h$, a = 8.53 A.U., 6 Mg and 33 Zn atoms/unit cell. The same structure with a = 8.29 A.U. was found with the ternary compound $Mg_3Cu_7Al_{10}$. Further cases where ternary compounds crystallize in binary types of structure are discussed. The analogy holds for binary compounds which often possess crystal structures of elements. EF (10)

**The Crystal Structure of $Co_9S_8$ and of Pentlandite $(Ni,Fe)_9S_8$.** MÄRTA LINDQUIST, DICK LUNDQUIST & A. WESTGREN. *Svensk Kemisk Tidskrift,* Vol. 48, July 1936, pages 156-160. In English. Previous X-ray work is considered. The existence of $Co_9S_8$ is reported; space group: $O_h^5$. The cell holds 4 groups of $Co_9S_8$. Edge length of the face-centered lattice = 9.907 A.U. The determination of the composition of the cubic cobalt sulphide is of special interest because it is isomorphous with one of the technically most important minerals, pentlandite. The formula $(Ni,Fe)_9S_8$ is suggested. The results of an X-ray determination on a Sudbury sample are given in detail. EF (10)

**Wall Thickness Sensitivity of Metals and Alloys (Wandstärkenempfindlichkeit von Metallen und Legierungen)** E. SÖHNCHEN & E. PIWOWARSKY. *Zeitschrift Verein deutscher Ingenieure,* Vol. 80, Aug. 1, 1936, pages 933-936. "Wall thickness sensitivity" is defined as the sensitivity of various characteristics and properties to the wall thickness and dependent effects (cooling velocity, grain size, etc.). Tests show that all casting alloys are wall-thickness sensitive, but the effect can be minimized, sand castings being more sensitive than chill mold, for example. Curves are given that indicate the influence of chemical composition and heat treatment for different metals and alloys, and a nomograph facilitating calculation of the strengths of materials of varying thickness is shown. Ha (10)

**Austenite Transformation.** S. S. SCHTEINBERG. *Izvestia Sektora Fiziko-Khimicheskogo Analiza,* Vol. 8, 1936, pages 269-282. In Russian. Review compiled in 1933. NA (10)

**Structure of Thin Layers of Metals (Ueber die Struktur dünner Metallschichten)** R. RIEDMILLER. *Zeitschrift für Physik,* Vol. 102, Sept. 14, 1936, pages 408-415. Thin layers of Ni, Au, and Ag of 100-1000 A.U. thickness when examined by X-rays had increased lattice constants of 1.2% for Ni, 0.8% for Au and 1% for Ag. The density of Ni in layers produced by vaporization was diminished by 18%. FHC (10)

**The Exact Measurement of the Specific Heats of Solid Substances at High Temperatures: Specific Heats, Electrical Resistance and Thermoelectrical Behavior of Titanium in Their Dependence on the Temperature.** F. M. DAEGER, E. ROSENBAUM & R. FONTEYNE. *Recueil des Travaux Chimiques des Pay-Bas,* Vol. 55, July 15, 1936, pages 615-654. In English. Experiments with pure ductile Ti proved that Ti occurs in 2 modifications: an α-modification of hexagonal symmetry, which is stable below 905° C. and a body-centered cubic β-form above 880°-905° C. The transition is not so slow as in Zr. The true atomic heats vary from 6.507 cal. at 200° to 8.901 cal. at 817° C. Although X-rays did not disclose any further modifications, minor "transition points" occur at 200°-250°, 297°, 400°, 508°, 630°, etc., as shown by agreeing calorimetric, electric and thermoelectric measurements in a high vacuum. The presence of minute traces of O—perhaps also N—in the metal with the probable production of invisible oxide films is assumed to be responsible for these minor discontinuities. The transition of $\alpha \rightarrow \beta$ Ti also proves to be affected by gas traces, the transformation resembling those in 2- or 3-component systems. EF (10)

**Electrolytic Polishing of Copper, Lead, Tin and Their Alloys and Its Application to Metallography (Sur de Polissage Électrolytique du Cuivre, du Plomb, de l'Étain et de leurs Alliages et ses Applications à la Metallographie)** P. JAQUET. *Bulletin de la Société Chimique de France,* Vol. 5, April 1936, pages 705-723. The advantages of the author's "electrolytic" preparation of brilliant and smooth surfaces on metals and alloys by electrolytic dissolution are emphasized and the shortcomings of conventional polishing methods in particular with reference to very soft materials are stressed. Utilization in metallographic work and commercial applications are considered. 14 of the 22 illustrations refer to microstructures (Cu, brass, bronze, Pb, Sn and Pb-Sn alloys) prepared by Jaquet's new method. EF (10)

The **Influence of Valence Electrons on the Crystal Structure of Ternary Magnesium Alloys (Der Einfluss von Valenzelektronen auf die Kristallstruktur ternärer Magnesiumlegierungen)** F. LAVES & H. WITTE. *Metallwirtschaft,* Sept. 4, 1936, pages 840-842. For a series of 8 ternary alloys with Mg the structures of phases on the $MgX_2$ section can be correlated with the ratio of valence electrons to atoms, analogous to the Hume-Rothery rule for binary systems. The $MgCu_2$ lattice occurs with ratios from 1.3 to 1.8, while the $MgZn_2$ lattice is found with ratios exceeding 1.9; the $MgNi_2$ lattice often exists for intermediate ratios. From a consideration of three additional systems containing Ni, it is shown that this element must be considered as having an effective valence intermediate between those of Cu and Zn. GD (10)

The **Equilibrium Diagram.** N. S. KURNAKOW. *Izvestia Sektora Fiziko-Khimicheskogo Analiza,* Vol. 8, 1936, pages 15-55; A. B. MLADZEEVSKIY. *Ibid,* pages 57-86. In Russian. Discusses the philosophy of chemistry-geometry relationship, particularly as it applies to the convenience of the phase diagram as a representation of physical and chemical changes. NA (10)

**On the Phase Transformation in the Solid State in Alloys of Iron and Chromium.** N. N. KURNAKOW & N. I. KORENEW. *Izvestia Sektora Fiziko-Khimicheskogo Analiza,* Vol. 9, 1936, pages 85-98. In Russian. With hardness measurement, electric resistance determination, and thermal analysis the formation of the compound FeCr at 908° C. was confirmed. The compound FeCr forms the limited range of the solid solutions. The decomposition of FeCr by heating is more rapid than its formation by cooling. NA (10)

**Methods of Physico-Chemical Analysis.** W. A. KISTIAKOVSKIY. *Izvestia Sektora Fiziko-Khimicheskogo Analiza,* Vol. 8, 1936, pages 5-13. In Russian. Classification of static, dynamic, and mixed methods, and some examples, are given. NA (10)

**X-ray Investigation of the Recrystallization of Copper and Alpha Brass (Röntgenographische Untersuchung der Rekristalisation von Kupfer und Alpha-Messing)** W. I. IWERONOWA & H. S. SCHDANOW. *Metallwirtschaft,* Vol. 15, Nov. 13, 1936, pages 1086-1088. The relation between recrystallization temperature and solid-solution formation was studied for α-brasses. From 5 to 40% Zn the recrystallization temperature falls with increasing Zn content. A maximum occurs in the recrystallization temperature-composition curve at about 5% Zn. The number of interference spots upon Deybe rings gives a quantitative picture of the recrystallization process. Cu seems to recrystallize in 2 stages; first, the growth of a relatively few grains, then a sudden increase in the number of new grains. In brass, on the other hand, recrystallization takes place suddenly. From the X-ray photograms and by use of a formula developed by one of the authors it was possible to investigate nuclei formation and the rate of grain growth. GA (10)


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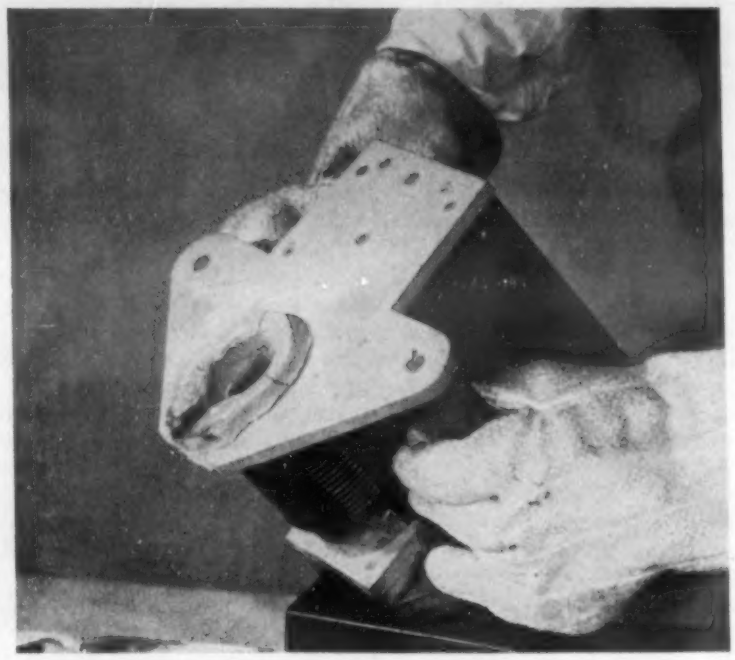

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**Study of Transformations Produced in Certain Metals by Heating in Vacuum or in Air (Étude de Transformations Produites dans Certains Métaux par le Chauffage dans le Vide ou dans l'Air)** JEAN-J. TRILLAT & SHIGUÉO OKETANI. *Comptes Rendus,* Vol. 203, Nov. 23, 1936, pages 1064-1066. Thin layers of gold varying from 50-70 μμ thickness were examined by electron diffraction methods. When heated in $N_2$ or A atmosphere, the ordinary fibrous structure appeared but, when held at 500° C. for 2 hrs., a new structure of hexagonal symmetry appeared superimposed on the former structure. The authors attribute this to mobility of the atoms in the superficial layers. When heated in a similar manner, Al, Cu and Fe give patterns of stable oxides. FHC (10)

**Ferrites.** A. E. VAN ARKEL, E. J. W. VERWEY & M. G. VAN BRUGGEN. *Recueil des Travaux Chimiques des Pays-Bas,* Vol. 55, May 15, 1936, pages 331-347. In English. X-ray investigation of oxide mixtures $MO + Fe_2O_3$ (M = bivalent metal) in varying proportions and exposed to various temperatures disclosed similar conditions to exist in many oxide mixtures rich in $Fe_2O_3$. The ferrite phase extends at elevated temperatures (up to 1300° C.) close to the $Fe_2O_3$-side but becomes more and more restricted at lower temperatures (800-1000° C.). The solid solutions with Fe contents higher than $Mo:Fe_2O_3 = 50:50$ can be interpreted as substraction phases. Compounds ($2MO \cdot 3Fe_2O_3$) as assumed by Hilpert *(Zeitschrift für physikalische Chemie B,* Vol. 18, 1932, page 291; Vol. 31, 1935, page 1) do not exist. $Mn_3O_4$ dissolves considerable quantities of $Fe_2O_3$ (at 1300° up to $Mn_3O_4:Fe_2O_3 = 1:6$), whereby its tetragonal lattice gradually changes to the cubic ferrite lattice. The high temperature solid solutions of $MgO + MgFe_2O_4$ and of $NiO + NiFe_2O_4$ slowly decompose at approximately 1000° C. The unit cell of the ferrites is at this temperature almost twice as large as that of the oxides. The decomposition can be checked only by calculated and observed interference intensities. The proof by magnetic determinations is more sensitive than that by X-rays, but the latter is more trustworthy than microscopic results. At the ratio $CuO:Fe_2O_3 = 3:1$ a new compound occurs in Cu-ferrite. **Ferrites (Ueber Ferrite)** R. S. HILPERT. *Ibid,* Vol. 55, Oct. 15, 1936, pages 963-966. In German. Controversial reply to findings of Van Arkel, Verwey & Van Bruggen in particular the question of occurrence of chemical compounds at the ratio $2MO \cdot 3Fe_2O_3$ (Cu and Zn-ferrites). EF (10)

**The Quantum Theory of the Electrical Conductivity of the Alloys in the Superlattice State.** TOSHINOSUKE MUTO. *Scientific Papers of the Institute of Physical & Chemical Research, Tokyo,* Vol. 30, Sept. 1936, pages 99-120. In English. Deals with the extension of Nordheim's theory of alloy conductivity to the superlattice alloy taking $Cu_3Au$ as a typical example. The method of treatment may be generalized easily to include other types of superlattice alloys. The author discusses: Bragg & William's statistical theory of superlattice, probabilities of electron scattering, specific resistance of superlattice alloys, and gives a comparison between theoretical deductions and experimental results. WH (10)

**The History of Thermal Analysis.** B. N. MENSCHUTKIN. *Izvestia Sektora Fiziko-Khimicheskogo Analiza,* Vol. 8, 1936, pages 373-408. In Russian. Review, with 112 references. NA (10)

**Relation between the Rate of Solution of Gold, Silver, and Copper Alloys in Cyanide Solution and the Binary Diagrams.** I. N. PLAKSIN & I. V. SHIBAEV. *Izvestia Sektora Fiziko-Khimicheskogo Analiza,* Vol. 9, 1936, pages 159-182. In Russian. The compounds AuCu and $AuCu_3$ showed maximum solution rates in the Au-Cu system. With Ag-Cu alloys, the eutectic showed the minimum solution rate. The minimum in the Ag-Au system exists at 40 at. % Au. NA (10)

**Magnetic Susceptibility of Binary Alloys of Thallium.** AUDREY W. DAVID & JAMES F. SPENCER. *Transactions of the Faraday Society,* Vol. 32, Oct. 1936, pages 1512-1516. The nature of binary alloys of Tl was investigated by measuring the variation of the mass susceptibility with change of composition using 15 Bi-Tl alloys and 10 Cd-Tl alloys. Measurements were made with specimens both as cast and annealed in vacuum at a temperature somewhat below the melting point. The Bi and Cd were the purest obtainable, confirmed by analysis, but analysis is not given, other than that there was less than .00001% Fe. Tl was purified and contained less than .000014% Bi, .00008% Pb, and .00001% Fe. No rod was used for magnetic measurement if a variation of more than 0.1% existed between the composition of the ends. The Cd-Tl alloys were tough. The Bi-Tl alloys with a low Tl content were brittle but with a Tl content above 40%, the alloys were less brittle. The mass susceptibility measurements were made at room temperature by the modified Gouy method using a field strength of about 5,000 gauss. For Cd, $-\chi \times 10^{-6}$ equaled 0.163; Bi 1.292 as cast and 1.320 if annealed; Tl 0.223; Bi with 34.50% Tl, 0.090 both annealed and unannealed; Bi with 70.62% Tl, 0.059 unannealed, and 0.054 annealed; Cd with 51.15% Tl, 0.196. The susceptibility-composition curve for the Bi-Tl alloys shows definite maxima at points corresponding to 36 and 71% Tl. These compositions are of the intermetallic compounds $Bi_5Tl_3$ and $Bi_2Tl_3$. The susceptibility-composition-curve for the Tl-Cd alloys shows no irregularities indicating that such alloys are mixtures and have mass susceptibilities which can be calculated from the mixture law. 13 references. PRK (10)

**The Alloys of Iron and Sulphur.** C. H. DESCH. *Iron & Coal Trades Review,* Vol. 133, Nov. 27, 1936, pages 939-940. The equilibrium diagram of the system Fe-S is discussed; only alloys containing small amounts of S are of interest in the metallurgy of Fe. FeS is the only sulphide of Fe which can exist in equilibrium with Fe. It forms, at room temperature, hexagonal crystals, and is nonmagnetic while the native mineral is magnetic. The diffusion of S in Fe was determined in the temperature range from 950° to 1150° C. and found to more than quadruple. Existence of solid solubility was confirmed but is uncertain except in the $\gamma$-range of pure Fe; other elements affect the relation of Fe and S. O is readily taken up by FeS and forms a eutectic of 58% FeS and 42% FeO, melting at 940° C. without reaction. Higher oxides react above 1300° C.: $FeS + 3Fe_3O_4 = 10FeO + SO_2$. Hot shortness caused by S is intensified by presence of O. C forms a eutectic of 87% FeS, 2.5% $Fe_3C$, and 10.5% Fe; m.p. 978° C. Mn causes a reaction $FeS + Mn = MnS + Fe$, MnS being insoluble in molten steel and separating in drops. P forms a system FeS-$Fe_3P$ with a eutectic of 14% FeS. Steels containing Al show the sulphides often in the form of minute globules which may be $Al_2S_3$. Zr forms finely-dispersed particles of $ZrS_2$. Ni can hold 0.02-0.03% S in solid solution at 1000° C., and 0.05% was formed at 644° C., the temperature of the Ni-NiS eutectic. Examination of Fe alloys with Ni and S did not indicate any solid solubility in Fe-rich alloys. Ha (10)

**Notes on the Preparation and Composition of Wüstite Phases.** E. E. WOOD & J. B. FERGUSON. *Journal of the Washington Academy of Sciences,* Vol. 26, July 15, 1936, pages 289-293. Discusses the dehydration of $Fe(OH)_2$, decomposition of Fe oxalate, reaction between Fe and magnetite. Experiments on the extension of the Wüstite phase are reported and compared with previous investigations. EF (10)

**Thermal Conductivity in Relation to Crystal Structure.** W. A. WOOSTER. *Zeitschrift für Kristallographie,* Vol. 95, Oct. 1936, pages 138-149. In English. A preliminary attempt has been made to correlate with their structures the anisotropies in thermal conductivity shown by a number of crystals. EF (10)

**The Crystal Structure of $Cu_3Sb$ and $Fe_2As$.** MAJKEN ELANDER, GUNNAR HÄGG & A. WESTGREN. *Arkiv för Kemi, Mineralogi och Geologi,* Vol. 12, No. 1, 1936, pages 1-6. In English. Continuing previous work on the Cu-Sb *(Zeitschrift für physikalische Chemie,* Sect. B. Vol. 4, 1929, page 453) and Fe-As systems, *(Nova Acta Reg. Soc. Scient. Upsaliensis,* IV, Vol. 7, No. 1, 1929, page 46) the isomorphism of $Fe_2As$ and $Cu_3Sb$ were re-examined. Powder photographs of $Cu_3Sb$ indicated that the comparatively simple structure suggested before must be correct. The calculated and observed reflection intensities were brought into agreement. Explanation of previous failures of powder photographs of $Fe_2As$ to give satisfactory parameter values is given. The interatomic distances in the lattices of $Cu_3Sb$ and $Fe_2As$ differ somewhat from the theoretical (polarization effect.) EF (10)

**The Two Coexisting Electron Lattices in Iron and Alloys of the Beta-brass Type. Application of the Melting Point Law (Sur les deux Réseaux-Éloctroniques Simultanes dans le Fer et les Alliages du Type du Laitin-$\beta$. Application de la Loi des Points de Fusion)** ROBERT FORRER. *Annals de Physique,* Vol. 5, May/June 1936, pages 719-756. The melting point law and hypothesis of electron lattice are applied to $\alpha$-Fe, $\beta$-brass and similar binary alloys, and to Heusler alloy, all of which possess two independent electron lattices: one of which is a supplementary electron lattice stable to the transformation ($\beta$-brass) or Curie point ($\alpha$-Fe) and a principal lattice stable to the melting point of the alloys or to the $\beta \rightarrow \gamma$ transformation (Fe). The electron lattices consist of a certain number of electrons. The valency of the principal lattice of $\beta$-brass and lattice valency of $\alpha$-Fe is 4, but the valency of the supplementary lattice is 3 and 3/2 for $\alpha$-Fe and $\beta$-brass respectively. The supplementary lattice valency requires exactly 3/2 valence electrons per atom which is characteristic for the body-centered lattice according to the Hume-Rothery law. The principal electron lattices of $\beta$-brass, $Cu_2MnAl$ and $\beta$-Fe are identical. EF (10)

**Order of Affinity of Metals for Copper, Iron, Cobalt, and Nickel.** A. S. RUSSELL. *Nature,* Vol. 138, July 25, 1936, page 161. There is a definite order of metals in regard to their ability to form compounds with copper. The order is: Al, Sn, Zn, Cd, Hg and Pb. Any metal on this list displaces from intermetallic combination one lower in the list. For combining with Fe the analogous list runs: Al, Sn, Zn, Hg, Cd and Pb, and for combination with Co and Ni the list is the same as for Fe. The orders are not those of the electropotential series. CSB (10)

**Anomalous Values of Lattice Spacings Obtained by Electron Diffraction.** E. PICKUP. *Nature,* Vol. 137, June 27, 1936, page 1072. Lattice spacings calculated from ring or spot patterns given by electron diffraction are still not entirely reliable. Numerous observers are quoted who have reported results differing from the accepted X-ray values. Discrepancies are of the order of 1%, far greater than the experimental errors, and may perhaps be due to variation of lattice spacings with crystal size for very small crystals. CSB (10)

**Diffraction and Selective Absorption of Atoms at Crystal Surfaces.** H. GERDING & W. J. NIJVELD. *Nature,* Vol. 137, June 27, 1936, page 1069. A theory accounting for the selective absorption of atoms when they impinge on crystals at certain angles and with certain velocities (experimental data of Frisch and Stern, *Zeitschrift für Physik,* Vol. 84, 1933, pages 430 and 443). The theory suggests that with certain critical velocities the impinging beam migrates freely along the surface in certain directions. Also suggests new mechanism of evaporation from crystal surface arising from diffraction of atoms having appropriate velocity and direction of migration. CSB (10)

**High Speed Steel, Carbide Segregate and Grain Size.** JAMES P. GILL. *Steel,* Vol. 99, Nov. 2, 1936, pages 65-66. From 1936 Edward De Mille Campbell memorial lecture before American Society for Metals. MS (10)

**Electrodynamics of Macroscopic Fields in Supraconductors.** F. LONDON. *Nature,* Vol. 137, June 13, 1936, page 991. A theory of supraconductivity in which the supraconductor is imagined as consisting of many individual regions, somewhat analogous to the elementary regions of spontaneous magnetization of a ferromagnet. The theory is applicable to phase transition in a supraconducting wire caused by the magnetic field of a current through the wire. CSB (10)

# 11. PROPERTIES OF METALS AND ALLOYS

**A Review of Recent Research Work in Plasticity.** A. NADAI. *Journal of Applied Mechanics,* Vol. 3, Sept. 1936, pages A104-106. From the report of the committee for the study of phenomena of viscous and plastic deformations. See *Metals and Alloys,* Vol. 7, Jan. 1936, page MA 39L/4. Ha (11)

**New Developments in Semi-Conductors (Neuere Untersuchungen an Halbleitern)** ALFRED SCHULZE. *Chemiker Zeitung,* Vol. 60, July 4, 1936, pages 545-547. Concise review of the electrical properties of several high resistance metals and metalloids. The materials discussed include magnetite, Si, C, Ti, Zr, Hf and Th, B, As, and Te. 12 references. FPP (11)

**The Atomic Weight of Molybdenum (Das Atomgewicht des Molybdäns. Analyse des Molybdänpentachlorids)** O. HÖNIGSCHMID & G. WITTMAN. *Zeitschrift für anorganische und allgemeine Chemie,* Vol. 229, Oct. 6, 1936, pages 65-75. Details give at. wt. = 95.95. WB (11)

**Electronic Specific Heat in Palladium.** G. L. PICKARD. *Nature,* Vol. 138, July 18, 1936, page 123. Measurements of specific heat at temperatures from 2.5° to 22° K, show electronic component in addition to component due to lattice vibrations, a fact useful in testing the modern electron theory of metals. CSB (11)

## 11a. Non-Ferrous

A. J. PHILLIPS, SECTION EDITOR

**Free Machining Aluminum Alloys (Ueber Aluminium-Automaten-Legierungen)** H. KÄSTNER. *Metallwirtschaft,* Vol. 15, Dec. 18, 1936, pages 1217-1221. Description of the machining characteristics of two German free machining aluminum alloys, one a high tensile alloy (WI 301), and the other possessing good corrosion resistance (WA 301). Theoretical considerations for producing a free machining alloy are discussed, and the author concludes that it is a question of having limited miscibility in the liquid state, rather than a question of specific alloying element or characteristic structure (hard particles in a soft matrix, etc.) Lead can be used to make free machining aluminum alloys but its relatively great density requires proper technique in alloying. GA (11a)

**Annual Report of the Public Printer. 1936.** A. E. GIEGENGACK. *U. S. Government Printing Office,* Jan. 5, 1937, 69 pages. During the past two years 5 different metals used in the Government Printing Office have been standardized to one metal, designated as "Universal." Compositions of these type metals were:

| | Sn | Sb | Pb |
|---|---|---|---|
| Linotype | 4.0–4.5 | 11.5–12.0 | remainder |
| Monotype, regular | 7.0 | 16.5 | remainder |
| Hard monotype, rules and large type | 10 | 19 | remainder |
| Ludlow | 6.5 | 11.5–12.0 | remainder |
| Stereotype | 9 | 14 | remainder |
| Universal | 6 | 12 | remainder |

This new, all purpose type metal has given entire satisfaction and has greatly simplified handling problems. About 10 million lbs. of type metal were standardized in 1936. BWG (11a)

**The Mechanical Properties of Aluminum-$MgZn_2$ Alloys as Sand Cast (Die mechanischen Eigenschaften einiger Aluminium-Legierungen mit Zusätzen von Mg-$Zn_2$ als Sandguss)** P. BERGMANN. *Metallwirtschaft,* Vol. 15, Nov. 29, 1936, pages 1146-1148. The mechanical properties of alloys in the quasibinary Al-$MgZn_2$ section of the Al-Mg-Zn system were investigated with regards to possible effects of treatment and small additions of alloying elements. Tensile strength and hardness increase with increasing $MgZn_2$ content, while elongation decreases. Air cooling of the cast test piece increases the tensile strength and hardness of alloys with high $MgZn_2$ content without impairing ductility. Ce and Th additions have no effect upon the mechanical properties while Mn increases the tensile strength and hardness without decreasing elongation. Heat treatments used were cooling in the mold; air cooling from 300° C.; and soaking at 500° C., quenching, then annealing 14 hours at 130° C. GA (11a)

**Investigation of the Paramagnetism of Nickel Alloys (Étude paramagnétique de quelques alliages de Nickel)** CHARLES MANDERS. *Annales de Physique,* Vol. 5, Feb. 1936, pages 167-231. The magnetic susceptibility in relation to temperatures up to 710° C. was studied in solid solutions of Ni and the metals Ag, Au, Al, Ti, Zr, Si, Sn, Pb, N, As, Sb, Cr, Mo, W, Mn, Ru, Pd and Pt. The data are graphically presented and compiled in tables covering some 40 pages of the paper. In the majority of the binary systems studied it was found that the susceptibility could be expressed by a simple equation, the constants of which are calculated by a method developed by Néel. In some cases the reciprocal value of the susceptibility as a function of temperature yielded straight lines with various distinct break points. EF (11a)

**Steel-Cored Copper.** G. W. PRESTON. *Electrician,* Vol. 111, Nov. 6, 1936, pages 569-570. Tensile strength and modulus of elasticity of steel-cored Cu conductors are discussed. CBJ (11a)

**Aluminum Casting Alloys (Aluminium-Formgusslegierungen)** R. IRMANN. *Metallwirtschaft,* Vol. 15, Oct. 16, 1936, pages 984-989. An historical survey of the development of aluminum casting alloys is given, with a discussion and tabulation of their physical properties. GD (11a)

**Copper That Can Be Hardened.** J. HAYDOCK. *American Machinist,* Vol. 80, Oct. 7, 1936, pages 841-844. Physical properties and treatment of a Cu alloy with 0.25-0.50% Ni and 2-2.25% Be are described. The alloy is heat-treated by heating it to 500°-575° F. and cooling in air. Effects of cold-working are removed by heating to 1450°-1500° F. and quenching in water; recrystallization and preservation of the supersaturated $\alpha$ structure occur. The improvement in physical properties, to 200,000 lb./in.$^2$ tensile strength and 360 Brinell hardness, is causd by prcipitation of the $\gamma$ phase of the supersaturated solid solution. Fields of application, as for dies and tools, contacts, Fourdrinier wires, etc., are described. Ha (11a)

**The Magnetic Investigation of the Plastic Deformation of Metallic Materials (Die magnetische Untersuchung der Plastischen Verformung metallischer Stoffe)** H. J. SEEMANN. *Metallwirtschaft,* Vol. 15, Oct. 2, 1936, pages 931-936. The principles governing the interpretation of magnetic susceptibility measurements, especially as regards non-ferromagnetic materials, are discussed. Existing experimental data are reviewed and it is concluded that more precise and complete measurements are required to determine whether or not mechanical work in itself influences the magnetic properties of non-ferromagnetic substances. No new work is described. GD (11a)

**The Valve Effect of Gas Layers on Aluminum Electrodes (Gassperrschicht auf Aluminium-Elektroden)** O. JANSCH. *Aluminium,* Vol. 18, Oct. 1936, pages 486-487. Treatment of Al with a.c. in an ammoniacal bath produces a surface layer, conducting when dry, that prevents the subsequent formation of an anodic oxide layer in $H_2SO_4$ bath. In pure $H_2O$ or in $H_2SO_4$ the layer forms a luminescent gas layer. Thus it is possible to immunize certain spots, if desired, against the anodic oxidizing treatment. Ha (11a)

**Precipitation-hardening and Double Aging.** R. H. HARRINGTON. *Metals Technology, American Institute Mining & Metallurgical Engineers, Technical Publication* No. 759, Dec. 1936, 15 pages. An alloy of 2.6% Co, 0.4% Be and 97% Cu can be precipitation hardened to a high strength and has good ductility and electric conductivity. No practical improvement can be effected in its properties by cold working between quench and draw; cold-workability is very limited after complete precipitation hardening. The effects of double aging of high-speed steel are cited as a probable example of double aging with an intermediate thermal strain. As a heat-treated cast alloy 0.4% Cr, 0.1% Be and 99.5% Cu combines good tensile properties with an electric conductivity of 75% that of Cu. Properties of this alloy are markedly improved by cold working between quench and precipitation reheat. Tensile properties are still further improved by a double aging treatment, including a cold reduction between the 2 reheats following the solution quench. Such treatment produces a proportional limit of 35,000 lb./in.$^2$, good ductility, and a conductivity 70% that of Cu. Room-temperature properties are unusually stable for reheat temperatures up to 400 or 500° C. JLG (11a)

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**Age-hardening of Aluminum Alloys, II—Aluminum-magnesium Alloy.** WILLIAM L. FINK & DANA W. SMITH. *Metals Technology, American Institute Mining & Metallurgical Engineers, Technical Publication* No. 760, Dec. 1936, 6 pages. An Al alloy with 10.30% Mg, 0.013% Si, 0.008% Fe and 0.005% Cu was rolled into sheet, quenched from 450° C. and then aged for various times at different temperatures. Microscopic examination, lattice-parameter determinations, and tensile tests were made on treated specimens. Lattice parameter did not change by precipitation of minute particles during age hardening as it does under equilibrium conditions. Precipitation at grain boundaries can be observed microscopically before aging has progressed far enough to change yield strength and elongation measurably. Changes in yield strength and elongation are coincident with appearance of precipitation within grains. The phase $\beta'$, which precipitates at normal aging temperatures, has a crystal structure different from the equilibrium phase $\beta$. See also *Metals and Alloys,* Vol. 8, Jan. 1937, page MA 32L/1. JLG (11a)

**Progress in the Development and Application of Aluminium and Its Alloys.** G. A. ANDERSON. *Metallurgia,* Vol. 15, Dec. 1936, pages 33-36. Discusses production of super-purity Al, alloy improvements, free-cutting alloys, improved forging and casting alloys, and Al reflectors. JLG (11a)

**Magnesium in Ultralight Alloys (Magnesium des Alliages Ultra-legers)** P. BASTIEN. *Usine,* Vol. 44, Nov. 12, 1936, page 31. General review. See *Metals and Alloys,* Vol. 7, Aug. 1936, page MA 417L/4. Ha (11a)

**Radioactive Isotopes of Nickel, Copper and Zinc.** C. B. MADSEN. *Nature,* Vol. 138, Oct. 24, 1936, page 722; F. A. HEYN. *Ibid.,* Vol. 138, Oct. 24, 1936, page 723. Neutron bombardment produces radioactive Ni, Cu and Zn. CSB (11a)

**Boron, the Metal and Its Uses.** L. SANDERSON. *Sands, Clays Minerals,* Vol. 3, Nov. 1936, pp. 33-35. **Boron, Some Notes on an Interesting Element.** IBID. *Can. Mining J.,* Mar. 1937, pp. 139-141. An historical sketch of the development of use of B is given, and the principal sources, types of deposits, methods of extraction and physical and chemical constants are described. Methods of determining B in Fe or steel are outlined. Ha + WHB (11a)

## 11b. Ferrous

V. V. KENDALL, SECTION EDITOR

**Influence of Nitrogen on Welds (Contribution à l'Étude du Rôle de l'Azote dans Soudures)** ALBERT PORTEVIN & D. SEFERIAN. *Revue de Métallurgie,* Vol. 33, Dec. 1936, pages 705-720. By melting bare Fe wires in electric arc, their N content can be raised to 0.15-0.20%. Comparatively low absorption is caused by decomposition of only 30% of molecular N into atomic N at 3,700° C., the temperature of the arc. The total amount absorbed depends on many factors. Dilatometer showed a distinct break on the curve at 590° C. in steels containing more than 0.14% N, this break varied in sharpness in proportion to N content. With N below 0.14% two distinct breaks were observed, the distance between them being inversely proportional to N content. Quenching steels containing more than 0.14% N indicated the similarity between influence of N and C. Quenching from 950° C. produces solid solution which, in analogy with C alloys, can be called "nitro-austenite;" quenching from 800° C. gives acicular structure similar to martensite ("nitromartensite," according to authors' terminology), while annealing at lower temperatures results in α Fe carrying needles of Fe nitrides or their eutectoid with α Fe, braunite. When N is under 0.14% quenching results only in solid solutions of N in Fe. JDG (11b)

**Studies of Casting Stresses in Chilled Iron Rolls.** J. ERLER. *Foundry Trade Journal,* Vol. 55, Oct. 1, 1936, pages 252-255. Paper presented on behalf of the American Foundrymen's Association to the Düsseldorf Conference. If the relative modulus of elasticity does not exceed ¼ of the ultimate, it will increase from the center of the roll to nearly double on the chilled zone. Tension and compression have the same relative modulus within those limits. If the relative modulus of elasticity does not exceed ¼ of the ultimate strength the Poisson ratio—⅓—can be calculated. The stresses are compressive in the surface and tensional within the roll when the rolls are stripped at a very low temperature. The rate of solidification of the metal in the necks has an effect on the magnitude of the stress within the roll. Deeper chill will increase the tangential stress on the outer zone and the radial stress in the center of the roll. AIK (11b)

**Alloy Steels.** E. H. GUMBART. *Southern & Southwestern Railway Club Proceedings,* Vol. 23, Sept. 1936, pages 12-32. Definitions of alloy steels, alloying elements, and physical properties of various compositions are given and the fields of application discussed. Ha (11b)

**Controlled Grain Size in Steel.** T. SWINDEN & G. R. BOLSOVER. *Iron & Steel Institute,* Advance Copy No. 15, Sept. 1936, 30 pages. The inherent grain size as determined by the McQuaid-Ehn test has not received the consideration in England that it deserves. Test data are cited to show that inherently fine-grained steels of medium C and the low-alloy type have, for a given strength after heat treatment, a higher impact resistance and that their ductility is slightly greater than for coarse-grained steels made from the same heat. Fine-grained steels are also less liable to crack in quenching. Control of grain size and the theory of grain-size control are discussed. The theory that fine-grained steel results from minute particles of $Al_2O_3$ is questioned. It is suggested that the degree of deoxidation of the finished steel controls the grain size. JLG (11b)

**Steel as Basic Material in Surface Protection (Stahl als Grundwerkstoff in der Oberflächenschutztechnik)** R. WALZEL. *Berg- und Hüttenmännisches Jahrbuch,* Vol. 84, Aug. 28, 1936, pages 95-103. Properties of steels used principally for rustless and stainless steels, methods of their production, and compositions are reviewed. The economical importance of this industry is discussed with particular reference to Austria. 12 references. Ha (11b)

**Washing Machine Tub Dies Show Good Performance.** *Steel,* Vol. 99, July 27, 1936, page 45. Dies are of cast-Fe containing 2-4% Ni and 0.75-1% Cr, depending upon severity of draw. As cast, Brinell hardness is 250-300, and tensile strength, 40,000-50,000 lbs./in.$^2$ After heat treatment, hardness is 450-550, and tensile strength 30,000-40,000 lbs./in.$^2$ Good wear resistance obtained by heat treatment eliminates former practice of using hard steel inserts at points of extreme wear. Metal has a fine grain structure, takes a high polish, and eliminates any undesirable galling and streaking in metal being formed. A set of dies has turned out over 176,000 round tubs without redressing. Ordinary unalloyed cast-Fe dies require redressing after each 2,000-10,000 pieces. MS (11b)

**The Influence of Vanadium on Nickel-chromium and Nickel-chromium-molybdenum Steels.** H. H. ABRAM. *Iron & Steel Institute,* Sept. 1936, Advance Copy No. 6, 9 pages. V in amounts up to 0.5% was added to 30-lb. heats of Ni-Cr and Ni-Cr-Mo steels containing approximately 0.3% C. Forged bars were quenched and tempered and their properties determined. Additions of V above 0.1% tended to preserve almost constant the mechanical properties when the hardened steels were progressively tempered in the range 500-650° C. This was attributed to temper hardening caused by the precipitation of V carbide from super saturated ferrite counteracting the normal softening produced by tempering. This effect of V permits considerable latitude in tempering temperature. The quenched and tempered steels had good combinations of mechanical properties and precipitation of V carbide did not lower impact resistance. For the steels examined a V content between 0.15 and 0.25% seemed to be the most suitable. JLG (11b)

**Gray Cast Iron** JOHN W. BOLTON. *Foundry,* Vol. 64, Jan. 1936, pages 36-37, 76, 78; Feb. 1936, pages 35, 86-88; Mar. 1936, pages 35, 74, 77; Apr. 1936, pages 45, 93, 96; May 1936, pages 45-46, 110, 112, 115; June 1936, pages 34, 94; July 1936, pages 33-34, 80, 83; Aug. 1936, pages 32-33, 60; Sept. 1936, pages 32-33, 80; Oct. 1936, pages 44, 47-48; Nov. 1936, pages 32-33, 79; Dec. 1936, pages 44, 47. (Includes references at end of most of instalments.) A series of articles that eventually will appear in book form. (Jan.) Deals with the effect of Mo, Al and As on cast Fe; (Feb.) effect of Sb, Ba, Be, Bi, Ca, Ce, Co and Cu; (Mar.) effect of Pb, Sn, Na, Mg, Ti, W, U, V, Zn and Zr; (Apr.) considers effect of superheating on cast Fe; (May) deals with cooling rate; (June) influence of gases; (July) properties of cast Fe; (Aug.-Dec.) general physical constants—melting and freezing points, expansion and growth, coefficient of expansion, specific gravity, effect of graphite and Si on heat conductivity, effect of pouring temperature, electrical resistivity, and strengh and elasticity. See *Metals and Alloys,* Vol. 7, May 1936, page MA 260L/4. VSP (11b)

**Technological Properties of Large (Mechanically) Plated Sheets (Technologische Eigenschaften grosser plattierter Bleche)** W. RÄDECKER & E. SCHÖNE. *Zeitschrift Verein deutscher Ingenieure,* Vol. 80, Sept. 19, 1936, pages 1163-1165. The stress distribution in steels clad with Ni, Cu, rustless steel and Monel by high temperature rolling-on was investigated at 20° and 300° C. Results confirm absorption of stresses of the plated material by both the steel base and the cladding, and the maintenance of mechanical property values of both up to 500° C. Elastic modulus and thermal conductivity values are tabulated and a method of selecting cladding material on the basis of these results is described. Manufacturing processes are briefly discussed. Ha (11b)

**Castings.** F. M. ROBBINS. *Southern & Southwestern Railway Club Proceedings,* Vol. 23, May 1936, pages 8-29. With discussion. A brief outline, accompanied by tables of physical properties of common grades of ferrous castings on the market, is given. Their particular suitability because of rigidity, resistance to fatigue and to shock and wear in railroad operation is emphasized. Ha (11b)

**Armco Iron for Porcelain Enamel.** EDGAR SCHELLENBACH. *The American Enameler,* Vol. 9, Nov. 1936, pages 10-11. General discussion of manufacturing process, and a few of the properties of Armco iron. RAW (11b)

**Steels and Alloys for Permanent Magnets.** K. L. SCOTT. *Metal Progress,* Vol. 30, Sept. 1936, pages 64-68, 88. Discussion of testing permanent magnet alloys and interpretation of such tests. Methods of "aging" or application of demagnetizing influences for stabilization are described. Heat treatments and compositions are given for 12 magnet steels with $H_c$ 43-235. Melting practice and magnetizing of magnets are discussed. Materials available for permanent magnets of wide variety of properties have been extended by introduction of C-free alloys of precipitation hardening type and molded aggregates from powdered metals. The possibilities and properties of these materials are briefly discussed. WLC (11b)

**Mechanical Properties of Steels Heated in $H_2$ under Pressure (Propriétés Mécaniques des Aciers Traités par l'Hydrogène Chaud sous Pression)** LÉON JACQUÉ. *Comptes Rendus,* Vol. 203, Nov. 9, 1936, pages 936-938. A series of low alloy steels containing small amounts of Ni, Cr and/or Mo and V were formed into well polished tensile test samples and heated in $H_2$ under a pressure of 2,000 lbs./in.$^2$ for 12 hrs. at 500° C., 50 hrs. at 500° C. and 50 hrs. at 550° C. Charts are drawn to show the variation in tensile strength and elongation, the amount of decarburization and the loss or gain in weight. FHC (11b)

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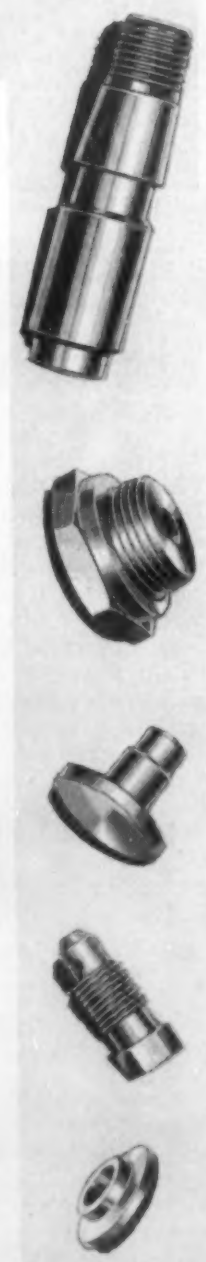

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**Molybdenum in Special Structural Steels (Il Molibdeno negli Accia speciali da Costruzione)** T. NATALE. *Industria Meccanica,* Vol. 18, Oct. 1936, pages 615-619. The improvement in structural Cr- and Ni-steels of low C content by addition of Mo is discussed and the possible economies because of the better mechanical properties shown in curves and micrographs. Ha (11b)

**Tensile Properties of Gray Cast Iron as Dependent on Wall Thickness and Location in the Cast Iron Diagram (Die Festigkeiteigenschaften des grauen Gusseisens in Abhangigkeit von der Wanddicke und der Lage im Gusseisendiagramen)** H. UHLITZSCH & K. APPEL. *Giesserei,* Vol. 23, Sept. 25, 1936, pages 524-531. The effects of C, Si and wall thickness on the mechanical properties of gray Fe were investigated and empirical curves of equal tensile strength established. Hardness is affected by the structure, tensile strength by form of graphite and structure, and bending strength by graphite formation. The wall thickness sensitivity of cast Fe decreases with decreasing C and Si contents. Hardness is not the only measure of wall thickness sensitivity; a diagram is developed that shows the relation between reduction in hardness and in tensile strength at different wall thicknesses. For cast Fe with high C and Si contents the tensile strength decreases faster than the hardness. In cast Fe with poorer mechanical properties, the % decrease in tensile strength is about equal to that in hardness. Ha (11b)

**Tungsten Carbide and Its Application to Dies and Tools.** A. R. ZAPP. *Wire and Wire Products,* Vol. 11, Oct. 1936, pages 566-568. Manufacture of sintered carbides, qualities of the material and sizes used are described. Ha (11b)

**Chromium-Molybdenum Steel as High Strength Structural Material.** S. G. BOGDANOV. *Kachestvennaia Stal,* Vol. 4, No. 8-9, 1936, pages 31-35. In Russian. Steels containing 0.31% C, 0.40% Mn, 0.23% Si, 2.34% Cr, 0.36% Mo; and 0.34% C, 0.45% Mn, 0.23% Si, 0.15% Mo were investigated for physical properties at room temperature, at —60° C. and in the temperature range 100-1200° C. in steps of 100° C. Properties of these steels closely resemble properties of Ni-Cr steels. (11b)

**Influence of Carbon on Physical Properties of Steel at Elevated Temperatures.** A. M. BORZDIKA. *Metallurg,* Vol. 11, Sept. 1936, pages 29-34. In Russian. A critical survey of literature data. (11b)

1 **The Selection of Wire Spring Materials.** J. W. ROCKEFELLER, JR. *Wire & Wire Products,* Vol. 11, Oct. 1936, pages 521-526, 592-593. Points of importance in selecting a material for springs according to the purpose the spring must serve, and changes which may be caused by heat-treatment in different kinds of wire are discussed. Steel for hard drawn springs has usually 0.5-0.65% C, 0.7-1.0% Mn, 0.1-0.2% Si. Music wire has 0.7-1.0% C, with only 0.25-0.40% Mn. Oil-tempered spring wire is usually made of basic open-hearth rod with 0.6-0.7% C, and alloy steels of Cr-V, Si-Mn, and a rust-resisting steel with not more than 0.12% C, 17-20% Cr, 8-10% Ni, are used. Of non-ferrous metals, phosphor bronze, spring brass and Monel metal (70% Cu, 30% Ni), Ni-silver (55% Cu, 27% Zn, 18% Ni) and lately Be-Cu (97.75% Cu, 2.25% Be) are employed. Heat treatment best suited for these materials is described. Ha (11b)

3 **Physical and Chemical Properties of Highly-alloyed Chrome Castings (Die physikalischen und chemischen Eigenschaften des hochlegierten chromgusses)** K. ROESCH. *Giesserei,* Vol. 23, Sept. 11, 1936, pages 472-480. Cr-castings are corrosion-resistant only within a definite composition range. Two major types are: (1) 25-32% Cr and 0.3-1.5% C, ferritic, highest resistance to acids; (2) 14-16% Cr and 0.10-0.30% C, martensitic, with limited resistance. 4-6% Cr and 0.15-0.30% C cast Fe is used in oil-cracking apparatus. The ratio of C to Cr in the first type is most important; the ferrite must contain at least 14% Cr in solution, and 1% C must be balanced with at least 10% Cr. Corrosion resistance is due to surface passivation. No heat treatment is required to maintain corrosion-resistance of the ferritic type. Scaling-resistance is roughly proportional to Cr content, with a maximum at 32% Cr and scale-resistance at 1200° C. Creep strength, melting and pouring properties were tested, and in these respects chrome castings are similar to malleable Fe. 16 references. Ha (11b)

5 **Nickel-free Alloys of High Magnetic Stability.** V. S. MESKIN & YU. M. MARGOLIN. *Kachestvennaia Stal,* Vol. 4, No. 8-9, 1936, pages 23-30. In Russian. Magnetic stability until now could be achieved either by mechanical means or by the use of Ni-Fe alloys. The present investigation was directed towards establishing the relation of concentration or precipitation phenomena of a system to its magnetic properties. Systems Fe-Mo, Fe-Si, Fe-Cu, Fe-P, Fe-Ni-Al, Fe-Mn-Al and complex α alloys of Fe with Mn, Al, Cr, Si and Cu were studied in detail. Magnetic stability of Fe alloys increases with the concentration of solid solution. With the decomposition of it the stability decreases. Several metals were developed and studied that contain no Ni but have high stability, low hysteresis loss, high specific resistance and satisfactory mechanical properties. (11b)

6 **Cast Iron and Its Present Position as Construction Material (Das Gusseisen und seine heutige Stellung als Konstruktionswerkstoff)** A. THUM. *Giesserei,* Vol. 23, Sept. 11, 1936, pages 460-466. General survey of processes, grades, mechanical properties, structural uses and testing methods. See *Metals and Alloys,* Vol. 6, Sept. 1935, page MA 379L/5. Ha (11b)

7 **Influence of Silicon on Properties of Steel.** V. N. KONSTANTINOV. *Metallurg,* Vol. 11, Sept. 1936, pages 35-42. In Russian. Steels containing 0.55-0.79% C, 1.66-2.54% Si, 0.51-0.79% Mn were investigated. Si raises critical points, but within 1.5-3.0% Si does not change the structure. It increases the critical quenching speed but does not affect the depth of hardness penetration. Si steels are less susceptible to overheating than Mn steels. Decarburization in heating grows with increasing Si content. At lower temperatures decarburization results in a layer of pure ferrite. Above the upper critical point it produces a much thinner ferritic layer, though the total depth of decarburization is greatly increased. When C is around 0.7-0.8% and Si not less than 2% graphitization is often observed. Greater Si content leads to increased fatigue and torsion strength, but has little influence on the results of the usual tensile testing. (11b)

9 **Isothermal Transformation of Austenite in Alloy Steels and Mechanical Properties Produced by It.** I. E. KONTOROVICH. *Kachestvennaia Stal,* Vol. 4, No. 8-9, 1936, pages 13-18. In Russian. Magnetometric and quenching methods were used for determination of the degree of austenite decomposition. The following steels were studied: 0.20% C, 0.99% Cr; 0.40% C, 0.92% Cr; 0.36% C, 1.21% Mn, 1.54% Cr; 0.30% C, 0.92% Cr, 0.21% Mo; 0.14% C, 1.86% Cr, 3.66% Ni; 0.23% C, 0.72% Cr, 2.82% Ni; 0.39% C, 1.55% Cr, 3.46% Ni; 0.28% C, 1.27% Cr, 0.39% Mo, 0.78% Al; 0.31% C, 1.21% Mn, 1.42% Cr, 0.52% Mo, 0.59% Al; 0.38% C, 0.86% Mn, 1.72% Cr, 0.56% Mo and 0.21% C, 1.84% Cr, 4.65% Ni, 0.81% W. Each of them is treated in detail both from decomposition and tensile properties standpoints. The steels behaved according to the general conception of the mechanism of decomposition. (11b)

# 12. EFFECT OF TEMPERATURE ON METALS AND ALLOYS

*The abstracts in this section are prepared in co-operation with the Joint High Temperature Committee of the A.S.M.E. and the A.S.T.M. The purpose of this co-operation is to make readily available complete references to the literature of this subject. The Committee does not necessarily subscribe to the statements of either the author or the abstractor.*

**Creep Characteristics of Stainless Steels.** S. I. WOLFSON & A. M. BORZDIKA. *Kach. Stal,* Vol. 4, No. 8-9, pp. 8-12. In Russian. Creep characteristics of 12% Cr steel, silchrome (0.4% C, 3% Si, 10.2% Cr), 18-8, and a specially prepared steel having the composition: 0.40% C, 0.36% Si, 8.9% Mn, 17% Cr, 2.2% W and 0.28% Ti were compared between 400 and 600° C. The results obtained on the older types of steel check published data reasonably well. Mn-Cr-W steel has creep strength twice as high as 18-8. (12)

**Speed of Oxidation of Metals at High Temperatures. Nickel, Copper, Iron, Brass (Vitesse d'Oxidation des Métaux à Température Élévé. Nickel, Cuivre, Fer, Laiton)** ALEXANDRE KRUPKOWSKI & JEAN JASZCZUROWSKI. *Rev. de Mét.,* Vol. 33, Nov. 1936, pages 646-653. Flat polished specimens were suspended from the beam of a sensitive balance located above the furnace in which specimens were heated, as in Heindlhofer & Larsen method (*Transactions* A. S. S. T., Vol. 21, 1933, page 865. See *Metals and Alloys,* Vol. 5, Nov. 1934, page MA 540). Oxidation of Ni in the 900-1200° C. range followed parabolic law, but the data obtained were somewhat lower than those of Pilling & Bedworth. Cu oxidation was studied in the range 631-1069° C. At lower temperatures some CuO is formed, but afterwards only $Cu_2O$ is found; oxidation follows parabolic law, and present investigation gave higher values than previous work. During oxidation of Fe a layer of FeO is formed which is saturated with oxygen. This condition prevails until all Fe is oxidized, after which the oxide layer is composed of $Fe_3O_4$. Until Fe is completely oxidized the reaction condition can be expressed by $w^2 = kt$; the rate of conversion of FeO into $Fe_3O_4$ can be given by $(w - w_1)^2 = k_1(t - t_1)$ and the third stage, formation of $Fe_2O_3$, by $(w - w_2)^2 = k_2(t - t_2)$. The results obtained in the temp. range 646-1203° C. are presented in detail. For the Fe-FeO reaction A was found to be equal to 44,560 cal./mol. and $c = 45.13$ gm./cm.$^2$/min.$^{1/2}$; for FeO-$Fe_3O_4$ the values obtained were $A = 3850$ cal./mol. and $c = 2.19$ gm./cm.$^2$/min.$^{1/2}$; for $Fe_3O_4$-$Fe_2O_3$ they were $A = 43{,}420$ cal./mol. and $c = 2.02$ gm./cm.$^2$/min.$^{1/2}$. Results seem to be accurate because complete oxidation of original thin specimens eliminated complications introduced by the presence of iron core. Brass also oxidizes according to parabolic law. JDG (12)

**Industrial Apparatus for Determination of Thermal Conductivity of Metals up to 900° C. (Un Appareillage Industriel pour la Determination de la Conductibilité Thérmique des Métaux jusqu'a 900°)** GEORGES RANQUE, PIERRE HENRY & MARCEL CHAUSSAIN. *Rev. Mét.,* Vol. 33, Oct. 1936, pages 602-608. One end of a hollow cylindrical specimen is screwed into a water cooled block and the other end into a resistance heated block with heated parts imbedded in insulation. Thermocouple is moved vertically inside the specimen. Accuracy is reported to be within 2%. Corrections required for different factors involved are given. Thermal conductivity of Cu was found to be constant up to 575° C.; conductivity of Ni is constant up to its magnetic point and then continuously increases. Conductivity of Fe with 0.03% C. decreases continuously with the temperature and that for 18-8 steel increases with it. JDG (12)


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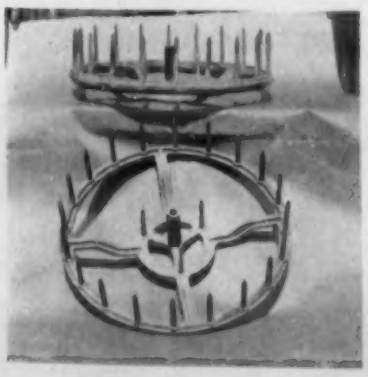

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# 13. CORROSION AND WEAR

V. V. KENDALL, SECTION EDITOR

**Corrosion in Lead Pipes and a New Alloy for the Conduction of Water (Corrosione delle tubazioni di piombo e di una nuova lega per la conduzione dell'acqua)** E. SORRENTINO & R. INTONTI. *Annali di Chimica Applicata,* Vol. 26, Sept. 1936, pages 385-398. An alloy containing 99.05% Pb, 0.75% Cd, and 0.09% As has been found to withstand almost twice the hydraulic pressure of ordinary lead pipes. Corrosion experiments show that this alloy, as well as Pb, is more soluble in waters containing high $CO_2$ and $O_2$. Traces of the As present are dissolved, but no more than with ordinary lead which also contains small amounts of As, and the quantities dissolved are below the minimum tolerated. Use of the proposed alloy would reduce the Italian requirements of Pb materially. AWC (13)

**Some Recent Investigations on Corrosion of Tin (Quelques récents recherches sur la corrosion de l'étain)** D. J. MACNAUGHTAN & E. S. HEDGES. *Revue de Métallurgie,* Vol. 33, July 1936, pages 431-437. A compilation of data published by the International Tin Research & Development Council. See *Metals & Alloys,* Vol. 7, Oct. 1936, page MA 508L/7. JDG (13)

**Corrosion in Railway Wagons.** *Times* [*London*] *Trade & Engineering,* Vol. 39, Sept. 1936, page 36. Many coal cars are scrapped each year because of corrosion of the steel plates, due partly to the coal and partly to the atmosphere. With all types of steel, proportional loss of weight is greatest in first 2 years. Results with Cu-bearing and low-alloy steel cars indicate that after about 18 months, corrosion-time curve assumes shape of a flat parabola. With plain C steel a very much sharper curve is obtained. Low-alloy steels requiring no special heat treatment, steel with 0.2-0.5% Cu, and Al are being used as materials to increase life of cars. Most used of the low-alloy steels contains 0.3-0.5% Cu, 0.8-1.5% Cr, 0.7-1% Si, and 0.1-0.2% P. In addition to increased corrosion resistance of these steels, mechanical properties are much improved. Al offers great resistance to corrosion by sulphurous coal. Life of 20 years on a corrosion basis as indicated by present experience. MS (13)

**Corrosive Conditions in Sewage Plants Provide Test for Finishing Materials.** JAMES A. MEACHAM. *Steel,* Vol. 99, Sept. 28, 1936, pages 59-60, 62. Discusses results of studies on nature of corrosion in different parts of sewage-disposal plants and on best methods for its control, and gives recommendations for finishing systems to be used. Raw sewage as delivered to plant is not as violently corrosive to steel constantly submerged in it as might be expected, due to the grit content and high $O_2$ demand at this stage. Metal located above surface of raw sewage, or in same room with it, is subject to severe corrosion due to fumes and condensation. Tests indicated that best protection was obtained by applying directly to bare metal, 2 coats of a special type of bituminous enamel. Where appearance is a factor, fume-resisting synthetic type enamels over suitable primers may be used. MS (13)

**Special Processes for the Surface Protection of Metals (Sonderverfahren des Oberflächenschutzes von Metallen)** R. MITSCHE. *Berg- und Hüttenmännisches Jahrbuch,* Vol. 84, Oct. 27, 1936, pages 116-124. The various methods of protecting iron from rusting and corroding by polishing, painting, covering with concrete, burnishing, and phosphating, are discussed and the latter method is described in detail. The influence of pretreatment with different phosphate baths on the first sign of attack and on the increase in weight of a mild steel in a salt spray was as follows:

| Pretreatment | First attack after hrs. | Increase in weight after 460 hrs. in % |
|---|---|---|
| None | 1.5 | 4.23 |
| Iron phosphate | 5.5 | 1.54 |
| Zinc phosphate | 8.5 | 0.27 |
| Manganese phosphate | 22.5 | 0.38 |
| Iron and zinc phosphate | 22.5 | 0.22 |
| Zinc and manganese phosphate | 70.0 | 0.22 |
| Manganese and iron phosphate | 70.0 | 0.45 |

The best protective effect is obtained when the ratio of phosphate to free acid is about 8:1, higher contents of free acid are harmful. The anodic treatment of light metals and their cladding with corrosion-resisting metals by rolling (welding) the latter on the surface of the metal to be protected are discussed. 9 references. Ha (13)

**Studies on the Oxidation of Metals. IV. The Oxide Film on Aluminium.** G. D. PRESTON & L. L. BIRCUMSHAW. *London, Edinburgh and Dublin Philosophical Magazine and Journal of Science,* Vol. 22, Oct. 1936, pages 654-665. The nature of the oxide film responsible for the remarkable corrosion resistance of Al and Al alloy surfaces is investigated physically and chemically. The film formed on Al at room temperature was isolated by removing the metal in HCl gas at 250° C. Electron diffraction photographs show that the film is amorphous. Heating the film at temperatures up to 650° C. does not induce crystallization but crystallization begins slowly at 680° C. The film becomes a random mass of small crystals of cubic $\gamma$ $Al_2O_3$, the form of $Al_2O_3$ present on the surface of molten Al. 11 references. See *Metals and Alloys,* Vol. 7, Mar. 1936, page MA 150R/7. Ha (13)

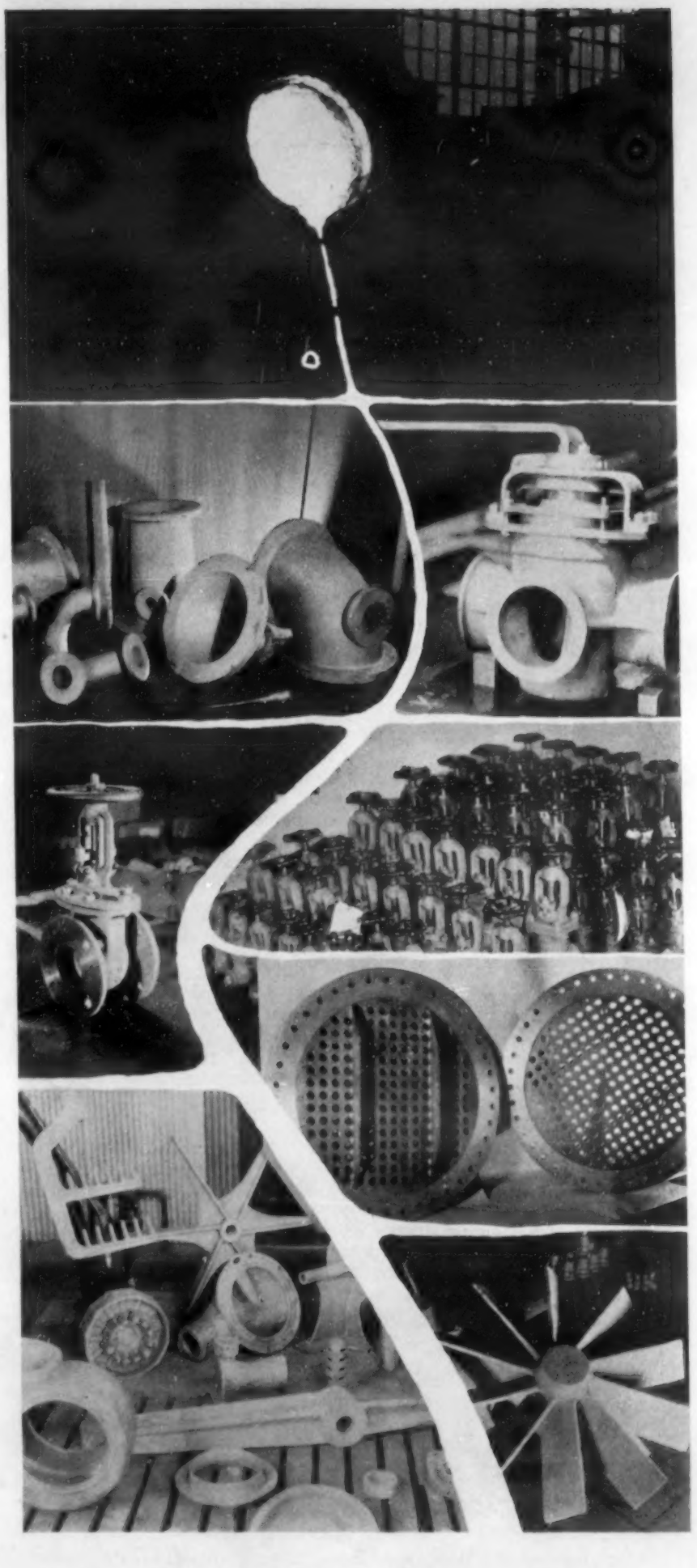
**Scaling of Mild Steel in Furnaces.** C. H. S. TUPHOLME. *Industrial & Engineering Chemistry, News Edition,* Mar. 20, 1936 pages 106-107. A report on the scaling of mild steel in S-free and S-containing furnace atmospheres presented at the British Institute of Gas Engineers as the Institution Gas Research Fellowship Report, made by H. C. Millet and John W. Cobb, Livesey Professor at the University of Leeds. It is pointed out that in 1929 the British steel production was 9,500,000 tons at £8 per ton, and in manufacture the loss of every one per cent of metal by scaling means a loss of £760,000. To this loss must be added the loss due to machining, processing, pickling, etc. The University of Leeds made a systematic and extensive survey of the amount of scaling by steel in furnace operations using small specimens and subjecting them to "neutral," oxidizing, or reducing atmospheres. The scaling was measured by increase in weight of sample after one hour exposure. It was found that scaling effect was quite negligible in $N_2$, more pronounced in $N_2$ plus $CO_2$, and still more so in $N_2$ plus steam. To completely eliminate scaling or even to reduce it to half, reducing atmospheres that are impracticable and wasteful would be necessary. Smoky atmospheres have no appreciable anti-scaling value. The anti-scaling effect, if any, is due to clean reducing gases. Scaling increases very rapidly with addition of small amounts of $O_2$ to "neutral atmospheres. At 700° C. 0.5% $O_2$ gave a scaling effect and further addition did not materially increase it. At 1000° C. scaling was much greater and increased rapidly with increase of $O_2$. 0.1% $SO_2$ in "neutral" atmospheres at 1000° C. gave the same increase in scaling as 1.0% free $O_2$. It was further stated that with 0.01% $SO_2$, representing a purified coal gas retaining 30 g. S per 100 ft.$^3$, the scaling was 0.0140 g./cm.$^2$, and further purification to reduce the S to 7 g. per 100 ft.$^3$ would reduce scaling only to 0.0125 g. At 1100° C. the scaling was 10 times greater for a 0.1% $SO_2$ furnace gas than at 700° C. The influence of small quantities of $SO_2$ was great in a "neutral" or reducing atmosphere, but it fell in atmospheres containing $O_2$, and appeared to vanish when the $O_2$ content was 3% at 1000° C. Further investigation along these lines will be continued. . . MEH (13)

**"Protection from Corrosion" by Suitable Surface Treatment ("Schutz von Korrosion" durch zweckmässige Oberflächenbehandlung)** H. KALLENBACH. *Oberflächentechnik,* Vol. 13, Oct. 20, 1936, pages 231-234. The phosphate treatment and other methods for cleaning, pickling and drying surfaces, and the various lacquers and varnishes used for finishes are reviewed. Ha (13)

**Protecting Idle Boilers against Corrosion.** J. P. MORRISON. *Locomotive,* Vol. 41, Apr. 1936, pages 38-42. Boilers that are to be idle for any length of time should be cleaned thoroughly inside and outside, all valves should be absolutely tight to exclude moisture, and the boiler kept dry, by placing unslaked lime on trays within the boiler. Ha (13)

**Kinetics of the Processes at the Iron Anode of a Galvanic Cell (Ueber die Kinetik der Prozesse an der Eisenanode eines galvanischen Elementes)** W. ROITER & W. JUSA. *Acta Physicochimica USSR.,* Vol. 4, No. 1, 1936, pages 135-144. In German. The polarization of the Fe anode (technically pure and electrolytic Fe) of a galvanic cell was investigated and expressed in an equation similar to Langmuir's adsorption isotherm equation. EF (13)

**Abrasion of Cast Iron under Gliding Wear (Abnutzung des Gusseisens bei gleitendem Verschleiss)** E. SÖHNCHEN & E. PIWOWARSKY. *Giesserei,* Vol. 23, Sept. 11, 1936, pages 489-491. The relations between structure, hardness and wear of ferritic, pearlitic and martensitic cast Fe of different composition and graphite content were investigated. Martensitic cast Fe showed least wear; but as ordinary cast Fe is not martensitic the addition of 5-6% Ni is necessary to produce a wear resistance 4-5 times that of pearlitic Fe. The relation between hardness H and wear W can be expressed for cast Fe by $W = 1/H^a$, a very steep hyperbola owing to the high value of the exponent. The relationships are plotted for a few types of cast Fe. 5 references. Ha (13)

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# 14. APPLICATION OF METALS AND ALLOYS

**Recent Developments in Metallurgy and their Influence on Engineering.** CHARLES-EUGENE SCHNEIDNER. *Journal of the Institute of Civil Engineers,* Vol. 240, 1936, pages 657-676. The production of Fe and steel for application in railways, shipping, electrical and other industries is reviewed. Improved methods of testing, increasing use of alloy steels, and application and uses of Al and Mg alloys in the aircraft and automobile industries are emphasized. JWD (14)

**Instrument Springs.** J. W. ROCKEFELLER, JR. *Wire & Wire Products,* Vol. 11, Nov. 1936, pages 632-639. Principles of design and material used for different purposes are described. Ha (14)

**"Emery" Flavor in Milk and the Influence of Metals on this Defect (Ueber den Fehler "schmirgelige" Milch und den Einfluss der Metalle auf diesen Fehler)** W. MOHR. *Molkerei-Zeitung (Hildesheim),* Vol. 50, June 16, 1936, pages 1454-55. The presence of traces of Cu causes an increase in the tendency of milk to acquire an "emery" flavor. The defect may result from heating in pasteurizers lined with Cu; it may also result from contamination due to the use of containers lined with bronze, brass, or Fe, and, to a less extent, Ni. Sn, Cr, Al, or various types of stainless steel do not contribute to the defect. GPS (14)

**Increasing the Fatigue Strength of Press-fitted Axle Assemblies by Surface Rolling.** O. J. HORGER & J. L. MAULBETSCH. *Journal of Applied Mechanics,* Vol. 3, Sept. 1936, pages A91-A98. Experiments showed that the mere pressure of a press-fitted member on axles reduces fatigue strength to less than one-half, but that the press-fit assembly can be made more than twice as strong by surface rolling the axle at the press-fit seat. The weakening action is due to a large stress concentration and erosion near the end of the pressed-on hub. 22 references. Ha (14)

**Evolution of New Metals.** B. D. SAKLATWALLA. *Industrial & Engineering Chemistry,* Vol. 28, Dec. 1936, pages 1366-1373. Discussion, CLYDE E. WILLIAMS, pages 1373-1374. Presented before the Division of Industrial & Engineering Chemistry of the American Chemical Society at the Pittsburgh Meeting, Sept. 1936. In the development of alloys, especially ferrous, novel effects rather than the superimposed effect of the individual elements are obtained. In the case of pure metals improvement seems to have been achieved by two opposite paths, the one by obtaining the metals in a superpure state, the other by adding to pure metals very small traces of impurities. In spite of the advance of the art of alloying, a strong tendency exists towards composite metal articles where two or more metals are united by some process of adherence, such as sintering, welding, electroplating, etc. Similarly, there are considerable possibilities of composite articles of metals and non-metals. The importance of corrosion is stressed not only as a matter of economic waste but also as a factor in equipment design, making possible light-weight construction with safety. Consideration is given to the requirements of extremely high or low temperatures, important for the future of the chemical industry. From the standpoint of the chemical engineers suitable metals are just as necessary for handling waste effluents and for shipping containers as for process equipment. MEH (14)

## 14a. Non-Ferrous

G. L. CRAIG, SECTION EDITOR

**High-frequency Technique and Aluminium (Hochfrequenztechnik und Aluminium)** A. HABERMANN. *Aluminium,* Vol. 18, Dec. 1936, pages 612-617. Owing to the skin effect the difference in electric resistance between Al and Cu decreases with increasing frequency. If Al is plated with a thin layer of Cu almost the same efficiency is obtained as with Cu. Tables for resistances of wires and tubes of Cu and Al are given, and applications in high-frequency apparatus described. Ha (14a)

**The Precious Metals as Materials for Decorating Pottery and Glass.** W. P. HARMSWORTH. *Sands, Clays & Minerals,* Vol. 3, Nov. 1936, page 49. The most used rare metals are, besides Ag, Au and Pt. Methods of bringing the metal into a form in which it can be applied on the glass ware and burnished are described. Although only minute quantities are used on a single piece, the total net consumption of precious metals for this purpose is considerable as it cannot be recovered again. Ha (14a)

**Bronze Wings for the Sea Queen.** A. EYLES. *American Machinist,* Vol. 80, Nov. 18, 1936, pages 945-947. The molding, casting and machining of the bronze propeller (55% Cu, 41% Zn, 2% Ni, 0.16% Mn, 0.84% Fe and 1% Al) for the Queen Mary is described in detail. Ha (14a)

**Surveys Uses of 34 Nickel-Bronze Casting Mixtures.** D. M. CURRY. *Steel,* Vol. 99, Aug. 24, 1936, pages 57-58. Tabulates composition of bronzes in which Sn is replaced in part by Ni, and outlines their uses. Consumption of Ni in such bronzes in 1935 increased about 300% compared with 1929. MS (14a)

**Silver for Dyestuffs Plant.** C. H. S. TUPHOLME. *American Dyestuff Reporter,* Vol. 25, Nov. 16, 1936, pages 628-629. The most extensive application to chemical plant is in condensation and general handling of acetic acid but other uses include condensers in the recovery of solvents, and in alloy form as valves, cocks and taps. Fine sheet Ag may be rolled on to Cu or other base metal, reducing first cost of the apparatus. Electrolytic Ag, due to its pronounced ductility, offers a great advantage in application to existing plant. Electrolytic Ag has a permanent investment value of 5-75% of the original cost of the plant. The behavior of electrolytic Ag towards a large number of acids and reagents is indicated. WHB (14a)

**Materials and Properties of Low Weight Steel Tanks (Werkstoffe und Eigenschaften von Leichtstahlflaschen)** CL. HOLZHAUER. *Die Wärme,* Vol. 59, Sept. 19, 1936, pages 613-617. Low-weight steel tanks of 170,000 lbs./in.$^2$ tensile strength have been developed in Germany for storing gaseous fuels for trucks. Cr-Ni-Mo, Cr-Mo and Cr steels are mainly used. The total alloy additions have been recently reduced from 1.5% to less than 1%. A high degree of purity, and particular care during melting and processing are claimed to be responsible for attaining physical properties which foreign steel makers can secure only by applying higher alloy additions. Destructive tests are fully described. Comparative impact and tensile tests on 3 heat-treated steels (no analysis given) are graphically reported. The destruction of the pressure tanks was obtained by falling weights, bullets, light artillery bombardment and explosions. The destruction was filmed, and some pictures are reproduced among the 16 illustrations accompanying the paper. (Priority for the application of "militarism" to metallurgy belongs to the U.S.A., however, for it was here that Ca bullets were first shot from a machine-gun into a metal stream being poured from a ladle. E.F.) EF (14a)

**Contacts with Special Metal Coats for Oil Switches (Schaltstücke mit Sondermetallauflage für Oelschütze)** KARL MEIER. *Elektrotechnische Zeitschrift,* Vol. 57, Apr. 30, 1936, pages 493-495. For contacts operating under oil, particularly resistant materials are now made of alloys of 70% W, 30% Cu, and 80% W, 20% Cu. Also W-Ag alloys are used. Alloys with more than 70% W must be produced originally in the shape ultimately required as they cannot be rolled or machined. The life of such contacts is 6-8 times that of Cu. The contact alloy, in a layer 3 mm. thick, is brazed to the base metal. Ha (14a)

**Aluminum for Pipe Sleeve Joints (Aluminium für Rohrmuffendichtungen)** REIPRICH. *Aluminium,* Vol. 18, Oct. 1936, pages 519-522. Al-wool was used for pressure pipe lines, and braided Al-foil for ordinary sewer pipes. 5-7 times as many pipe sleeve joints can be made with Al-wool as with the same weight of Pb-wool. Ha (14a)

**Aluminium Bus-bars.** C. H. RIDPATH. *Electrical Review,* Vol. 119, Nov. 20, 1936, page 711. Abstract of paper read before Association of Supervising Electrical Engineers. Deals with use of Al in place of Cu. Strength of extruded Al bar is not great, but its rigidity is superior to that of Cu equivalent. Al carries more current for same temperature rise than Cu of equal resistance. Bar might be of same depth but about 1.5 times thickness of Cu for equal capacity, whereas rod need be only 1.18 times diam. Allowable spacing between supports can be 38% greater than for Cu. Contact resistance can be lowered by first smearing with vaseline and then rubbing with emery, finally clamping bars without removing vaseline, which also averts Al-Cu contact corrosion due to moisture in air. There is a reduction in cost of bars when using Al. MS (14a)

**Experience with Gas Tanks Made of Light Alloys (Erfahrung mit Gasflaschen aus Leichtmetallen: Lautal, Bondur, Duraluminium)** N. CHRISTMANN. *Die Wärme,* Vol. 59, Aug. 22, 1936, pages 549-554. After several yrs. experimenting, light alloy gas tanks made by the Ehrhardt process have been developed. A great number of tanks were studied in corrosion tests. The German Government prescribes a protective coating on both inside and outside. The results of long-time corrosion tests and tensile tests are reported. EF (14a)

**Savings in Bearing Metal by Centrifugal Casting (Ersparnisse an Lagermetall durch Schleuderguss)** WAGNER. *Giesserei,* Vol. 23, Nov. 20, 1936, pages 619-623. Advantages of centrifugal casting special Pb alloys over Sn-rich bearing metals are a greater hardness of the running surface, better gliding properties, denser structure and better bond between bushing and bearing, greater reliability because of the higher melting point (245° C.), and longer life of the bushing. Bearings up to 350 mm. bore with 480 mm. length have been cast centrifugally. Ha (14a)

**Bearings of German State Railways (Die Fahrzeuglager der Deutschen Reichsbahn)** GARBERS. *Organ für die Fortschritte des Eisenbahnwesens,* Vol. 91, July 15, 1936, pages 293-312. Special chapters of this exhaustive treatment on bearings used in the rolling stock of German State Railways are devoted to the bearing materials, casting technique, and the physical testing of bearings. Microstructures of centrifugally cast Pb-Sb-Sn and an 80/12/6/2 Sn-Sb-Cu-Pb bearing are shown. WH (14a)

**Non-sparking Tools Help Make Process Industries Safe.** EDITORIAL STAFF. *Chemical and Metallurgical Engineering,* Vol. 43, Nov. 1936, pages 604-605. Al bronze and Be-Cu are the two most common non-sparking alloys. The Al bronzes have their hardness controlled without heat treatment from 100 to 350 points, hammers and wrenches being made from the softer grade, and tool cutters from the harder grade. Be-Cu has been standardized for certain tools such as scrapers and spatulas and is also preferred for tools which require both toughness and hardness, such as drills, chisels, pipe wrench jaws. In testing 2 open-end wrenches of similar design, the jaws of the Al bronze wrench spread at 220 ft. lbs. and the Be-Cu at 350 ft. lbs. PRK (14a)

**Copper-roofing of the Sacré-Coeur Basilica at Cointe-Liège (La Couverture en Cuivre de la Basilique du Sacré-Coeur à Cointe-Liège)** *Cuivre et Laiton,* Vol. 9, Nov. 15, 1936, pages 483-494. Architectural and constructive details are described; the different domes, gutters, spouts, etc., are covered with a total of 14,000 kg. Cu sheets. The thickness of the sheets varies from 0.5 to 0.75 mm. Ha (14a)

**Copper Radiators (Les Radiateurs en Cuivre)** *Cuivre et Laiton,* Vol. 9, Oct. 15, 1936, pages 439-445. Cu radiators for heating water are preferred to usual cast Fe type because of the former's better mechanical properties, thermal conductivity, appearance and wear resistance. For equivalent heating conditions Cu uses less water than Fe; also 22.5 g. of Cu can be used as contrasted with 60 kg. of Fe. Design data are given. Ha (14a)

## 14b. Ferrous

M. GENSAMER, SECTION EDITOR

**Cast Iron Pipe with Flexible Joints for Stream Crossing.** ALEXANDER ALLISON JR. *Engineering News-Record,* Vol. 117, Dec. 17, 1936, pages 853-855. Assembly of a flexible-joint water-main stream crossing is described. CBJ (14b)

**The Use of Alloy Steels for Side Frames and Bolsters of Freight-Car Trucks.** D. S. BARROWS. *Transactions of the American Society Mechanical Engineers,* Vol. 58, Nov. 1936, pages 727-731. The different types of side frames in use are reviewed and test results described. Ha (14b)

**Rail Maintenance—The Roadmaster's Problem.** C. B. BRONSON. *Railway Engineering and Maintenance,* Vol. 32, Nov. 1936, pages 697-700. From an address before the Roadmasters and Maintenance of Way Association Convention. Practices in manufacturing, laying and maintaining rail to give longer service are described. Controlled cooling, proper normalizing and hardening of rail ends at the mill are discussed. Methods of coding rails according to composition and heat treatment are given. The author destroys several popular illusions, among them the belief that the internal microstructure of rails is affected by usage, and the occasional opinion that the "life has gone out of a rail" or that the rail is "shot." Attention to defective joints by surface-grinding, cropping and building-up by welding is urged. FPP (14b)

**Steel Houses Are Assembled from Prefabricated Panels.** *Steel,* Vol. 99, Sept. 7, 1936, pages 46-48. Describes house constructed by National Houses, Inc. Standard outer wall steel sheet panels of 4-ft. and 2-ft. widths are assembled and bolted to foundation, then fastened together with clamps which take place of customary steel frame. Steel roof and floor pans are bolted to outer walls and to bearing partition studs. Interior walls consist of 2 ft. wide sheets of 20-gage steel designed to fasten to structural clamps. All concealed surfaces are treated with rust-proof paint. Specially processed vermiculite is used for insulation. MS (14b)

**Second Steel-Faced Dam Built for Colorado Springs.** *Engineering News-Record,* Vol. 117, Oct. 29, 1936, pages 599-603. Steel faceplates are set on light steel frames and welded into one piece. CBJ (14b)

**Cast Iron Paving Blocks.** E. W. DAVIS. *Mining Congress Journal,* Nov. 1936, pages 40-42, 47. Cast iron has been used for paving for more than 10 yrs. in Europe, particularly in places where the traffic is particularly heavy. Experiments carried out at the University of Minnesota indicate that cast iron paving blocks are more permanent than any other type of material. They can be laid very cheaply, the cost is favorable where traffic conditions are severe, and the skid-proof properties are at least as satisfactory as those of concrete. See *Metals and Alloys,* Vol. 6, Mar. 1935, page Ma 128L/3. BHS (14b)

**Making Steel for Die Blocks.** I. A. SUMIN & I. V. GOLUBEV. *Metallurg,* Vol. 11, May 1936, pages 61-90. In Russian. A detailed comparison of the practice used in the United States, Germany and Russia giving emphasis to the Russian practice. (14b)

**Mistakes to be Avoided when Specifying Alloy Steels.** *Product Engineering,* Vol. 7, Dec. 1936, pages 459-461. Mistakes commonly made in specifying steels are pointed out and means of avoiding them suggested. Ha (14b)

**Steel Bridges on the Kiel Canal.** *Railway Gazette,* Vol. 65, Aug. 14, 1936, page 271. Brief general description of structures. FPP (14b)

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**Automobile Service Pits Are of Copper-Bearing Steel for Long Life.** *Steel,* Vol. 99, July 13, 1936, page 40. Investigation of pits built of Cu-bearing steel, protected only by ordinary $Fe_2O_3$ paint, submerged in damp soil for 12 years revealed no measurable deterioration. Plates, cross angles, I-beams, channels, and nonskid floor plates are used in their construction. MS (14b)

**Light Steel Sections Used in New Type Roof Deck.** *Steel,* Vol. 99, July 6, page 60. Beams, known as Universal sections are cold rolled from 1 piece of 16-gage hot-rolled Cu-bearing strip steel. They are 2" deep and 1½" wide overall, weigh 1.38 lbs./ft., and are furnished dipped in rust-resisting paint or galvanized. For roof decks, sections are clipped or welded to purlins and a corrugated top sheet of 24-gage Cu-bearing steel is nailed to them. MS (14b)

**Light-weight Suburban Coaches (Voitures de Banlieue métalliques allégées)** M. PONCET & M. FORESTER. *Revue Universelle des Mines,* Vol. 12, Dec. 1936, pages 516-519. Use of cast steel tubes and plates (Belgian State Railways type E.S.) reduced weight of car from 41.5 tons to 32 tons. Ha (14b)

**Concrete and Steel in Trestle Construction.** R. P. HART. *Railway Engineering and Maintenance,* Vol. 33, Jan. 1937, pages 33-34. From a paper at the convention of the American Railway Bridge and Building Association. The reasons for substituting concrete and steel for wood in trestles are outlined. FPP (14b)

**Steel in Light Aircraft Construction (Stahl im Flugzeugleichtbau)** H. KALPERS. *Automobiltechnische Zeitschrift,* Vol. 39, Oct. 10, 1936, page 492. A few examples of pipe welded stainless steel assemblies, light enough to be useful in aircraft and hangar construction, are given. Ha (14b)

**High Duty Cast Irons. Malleable Cast Irons (Fontes Resistantes. Fontes Malléables)** A. PORTEVIN. *Memorial de l'Artillerie Francaise,* Vol. 15, Part I, 1936, pages 55-72. The author discusses the characteristics of these irons and their possible use in the manufacture of artillery shells. DJM (14b)

**High Duty Cast Irons (Les Fontes à Hautes Résistance)** C. BUCHET. *Memorial de l'Artillerie Francaise,* Vol. 15, Part I, 1936, pages 93-112. A discussion of the application of high duty cast-Fe to the problem of the manufacture of artillery projectiles. The author considers that the increased strength and homogeneity of the pearlitic cast irons will make possible a reduction in the wall thickness of projectiles. DJM (14b)

**The Development of Steel for Shipbuilding.** T. R. THOMAS. *Shipbuilding and Shipping Record,* Special Number, Dec. 30, 1936, pages 73-74. High and low tensile strength steels, and Cu and Cu-Cr steels resistant to marine corrosion are considered. The justification for reducing weight of high tensile steel structures by reducing scantlings is discussed. JDW (14b)

**The Present Position of Special Steels for the Heavy Oil Engine.** S. F. DOREY. *Diesel Engine Users Association,* S 132, 1936, 42 pages. **Special Steels for the Diesel Engine.** IBID. *Heat Treating and Forging,* Vol. 22, Nov. 1936, pages 567, 572; Dec. 1936, pages 622-625. **Special Steels for the Heavy Oil Engine.** IBID. *Mechanical World and Engineering Record,* Vol. 100, Oct. 16, 1936, pages 365-366, 380; Oct. 23, 1936, pages 395-396. The steels in current use for low and high speed heavy oil engines are discussed in relation to their resistance to fluctuating stresses at normal temperatures and at high temperatures, and their resistance to wear and to corrosion. The uses of these steels for crankshafts, connecting rods, piston rods, important bolts and studs, cylinder heads and liners, gudgeon pins, cams, rollers, fuel valves, and oil fuel injection pumps for both types of heavy oil engines are discussed. JWD + MS + WH (14b)

**Corrosion-Resisting Steels and Their Manipulation.** W. H. HATFIELD. *Chemical Trade Journal and Chemical Engineer,* Vol. 99, Oct. 9, 1936, pages 297-298; *Sheet Metal Industries,* Vol. 10, Aug. 1936, pages 618-620, 637. Extract from a paper presented to the Chemical Engineering Congress of the World Power Conference in London. Hot and cold working, hard soldering, brazing, soft soldering, welding and heat treatment of the Cr and Cr-Ni corrosion resistant steels are discussed. MS + AWM (14b)

**Quiet High Speed Gearing Entails Careful Design and Manufacture.** W. P. SCHMITTER. *Iron Age,* Vol. 138, Oct. 8, 1936, pages 38-46. *Steel,* Vol. 99, Oct. 19, 1936, pages 34-38, 56; Nov. 16, 1936, pages 45-48, 76. From a paper read before American Gear Manufacturers Association. Preliminary processes, heat treatment, forging, normalizing and finishing are described. VSP + MS (14b)

# 15. GENERAL

**Bakelised Bearings.** *Mechanical World & Engineering Record,* Vol. 99, June 5, 1936, pages 567-568. Bakelised bearings are capable of sustaining heavy loads. They are cooled by a continuous water spray, the water also acting as a lubricant within a certain range, although grease is used in some cases. Rolling mill bearings are claimed to be an "outstandingly successful application." WH (15)

**Metallurgical Development and the Mining Industry—A Review.** L. SANDERSON. *Canadian Mining Journal,* Vol. 58, Jan. 1937, pages 5-7. See *Metals and Alloys,* Vol. 7, May 1936, page MA 266L/1. WHB (15)

**Present State and Outlook of Technical Electrolysis (Stand und Aussichten der technischen Elektrolyse)** JEAN BILLITER. *Helvetia Chimica Acta,* Vol. 19, Aug. 16, 1936, pages E1-E32. The latest developments in the electrolytic production of Cu, Ag (briefly), Pb, Ni, Zn, Cd, Bi, Sb, Sn, Fe, Na, K, Be, Al, Mg are discussed at length on 25 pages. The balance of the paper refers to "non-metallic" electrolytic processes. EF (15)

**CO as a Chemical Raw Material.** NORMAN W. KRASE. *Chemical and Metallurgical Engineering,* Vol. 43, Nov. 1936, pages 690-695. Taken from paper "Carbon Monoxide as Raw Material for Chemical Synthesis" presented at the Baltimore meeting of the American Institute of Chemical Engineers, Nov. 11, 1936. Sources and uses of CO are mentioned. 42 references. PRK (15)

**Metallurgical Progress.** *Times [London] Trade & Engineering,* Vol. 39, Aug. 1936, page 9. Reviews recent developments in metals, processes, and tools. Includes Ni-clad steel; Ni wrought Fe; steel containing 1% Cr, 0.75% Si, 0.4% Cu, and 0.1% C for resisting corrosion; high-speed steel containing 10% W, 0.6% Mo, 2.10% V, 4% Cr, and 0.8% C; nitriding of high-speed steel; use of cemented carbides; bright annealing; hard facing; graded or interrupted hardening; and torsion impact tester. MS (15)

**Forward View of the Steel Industry—Men, Machines and Markets.** *Steel,* Vol. 99, Sept. 14, 1936, pages 80-81, 84, 87, 90. Discusses relationship between future important advances and problems of the industry. MS (15)

**The New Research Laboratory of the Mond Nickel Co.** *Engineer,* Vol. 162, Oct. 30, 1936, pages 459-460; *Engineering,* Vol. 142, Oct. 30, 1936, pages 472-474. Describes the layout and equipment of the research laboratory of Mond Nickel Co., Ltd., Birmingham. VSP (15)

**New Building of the Kaiser-Wilhelm Institute for Steel Metallurgy in Düsseldorf (Der Neubau des Kaiser-Wilhelm-Instituts für Eisenforschung in Düsseldorf)** *Mitt. Kaiser-Wilhelm Inst. Eisenforsch., Düsseldorf,* Vol. 18, No. 19, 1936, pages 253-314. *Stahl und Eisen,* Vol. 56, Dec. 31, 1936, pages 1569-1588. Views and layout of the buildings, laboratories, and apparatus are shown. The thermal analysis and X-ray room, lecture hall, metallographic and mechanical testing labs, machine shop, melting room, industrial hall, and ore treatment lab. are illustrated. SE (15)

**The Bauxite Industry in 1936—Advance Summary.** HERBERT A. FRANKE & C. T. HERRING. *U. S. Bureau of Mines, Mineral Market Reports* No. M.M.S. 514, Jan. 15, 1937, 2 pages. Statistical. AHE (15)

**Machine Tools.** *Iron Age,* Vol. 139, Jan. 7, 1937, pages 259-262, 266, 268, 270, 274-276, 279, 282-286, 290-292, 294, 296, 298-301. Claimed to be the first published list of every machine tool builder in the United States and the work that each is doing. VSP (15)

**Failures of Steel.** EUGENE W. NELSON. *Blast Furnace and Steel Plant,* Vol. 24, Oct. 1936, page 895. General discussion of relation of metallurgist to his industry. MS (15)

**Physics in the Metal Industry.** ZAY JEFFRIES & E. Q. ADAMS. *Journal of Applied Physics,* Vol. 8, Jan. 1937, pages 48-54. Constant application of physical principles in many metallurgical processes is pointed out. HFK (15)

**Metals.** T. W. LIPPERT. *Iron Age,* Vol. 139, Jan. 7, 1937, pages 200-202, 204, 208, 210, 212, 214, 218, 220, 222, 224, 226, 228. Reviews accomplishments during 1936 in the fields of plain cast Fe, alloy Fe, Cr steels, die casting alloys, cementation of Fe and steel with Be and Fe-Be, Pb base bearing metals, Mg-Zn and Mg-Al alloys. VSP (15)

**High Speed Photographic Methods of Measurement.** H. E. EDGERTON, J. K. GERMESHAUSEN & H. E. GRIER. *Journal of Applied Physics,* Vol. 8, Jan. 1937, pages 2-9. General article on high-speed photographic systems devised at M.I.T. Illustrations of the applications of such devices in special studies such as projectile photography, quenching of steels, combustion processes, etc., are given. Circuit diagrams and a bibliography are included. HFK (15)

**Development and Metallurgy of Manganese Alloy Steels.** *Steel,* Vol. 99, Oct. 26, 1936, pages 44-47. Prepared with collaboration of Metallurgical Dept. American Manganese Steel Co. Deals with development, properties, production and applications of 10-14% Mn steel. MS (15)

**Inland's New 43-Inch 2-High Blooming Mill Is Served by Circular Pits.** *Steel,* Vol. 99, Dec. 7, 1936, pages 46-48. Describes recently completed plant extension by Inland Steel Co., Indiana Harbor, Ind. MS (15)

**New Research Laboratory for the Mond Nickel Company.** *Heat Treating and Forging,* Vol. 22, Dec. 1936, pages 620-621. MS (15)

**Tips for the Metal Worker.** *Iron Age,* Vol. 138, Oct. 15, 1936, pages 201-202, 204. Describes several new developments of use to the metal worker. Among them are an electrical device for differential heat treatment of automobile parts; a new Cu paint, known as Coppercote, for protecting Fe, steel, wood, concrete or other surfaces; the Alumawell flux used in conjunction with a high tensile solder applied with a soldering iron or blow torch; K-seal used in steel treating to prevent excessive penetration of C; and orthosilicate for cleaning steel prior to tinning, electroplating or enameling. VSP (15)

**Metallurgy and Engineering.** WILLIAM LARKE. *Electrical Review,* Vol. 119, Dec. 18, 1936, page 855. Abstract of presidential address to the Junior Institution of Engineers. MS (15)

## 15a. Economic

**International Trade in Metals.** J. W. FURNESS & E. W. PEHRSON. *Mining and Metallurgy,* Vol. 17, Oct. 1936, pages 474-477. Shows 5 charts giving world production, consumption and principal trade relations in bauxite, Fe ore, pig Fe and the Pt-group metals for 1932. Includes brief descriptive material. Charts were prepared by the U. S. Bureau of Mines. Similar information on Sb, Cr, Cu, Pb, Mn, Hg, Ni, Sn, W and Zn was published in *Engineering and Mining Journal,* Feb. 1936. VSP (15a)

**Production of Primary Aluminum in the United States, 1893-1935—Revised Figures.** H. A. FRANKE & C. T. HERRING. *U. S. Bureau of Mines, Mineral Market Reports No. M. M. S. 500,* Dec. 3, 1936, 1 page. Statistical. AHE (15a)

**Nickel in Canada—the Rise of a Great Industry.** A. H. A. ROBINSON. *Sands, Clays & Minerals,* Vol. 3, Nov. 1936, pages 11-20. The importance and many diversified uses of Ni and its alloys are discussed and geographical data on deposits and mines, plants for refining and manufacture of Ni products, and methods employed are described. Statistics of production are given; 70,000 tons were produced in 1935. Ha (15a)

**The Mineral Resources of Brazil.** A. COWNLEY SLATER. *Sands, Clays & Minerals,* Vol. 3, Nov. 1936, pages 29-30. The minerals of Brazil and their geographical distribution are briefly discussed. Ores of Au, Mn, Ni, Cr, Ti, Zr, W and Cb occur in workable quantities; rutile and pyrolusie, galena, Cu ores are important economically. Ha (15a)

**Sunshine Output Grows.** J. B. HUTTL. *Engineering & Mining Journal,* Vol. 138, Jan. 1937, pages 13-14. Silver production has doubled since 1934 at the Big Creek, Idaho, plant of the Sunshine Mining Co. The mill treats 600 tons per day. WHB (15a)

**Continental Steel Cartel, Ten Years Survey.** *Iron & Coal Trades Review,* Vol. 133, Dec. 11, 1936, pages 1013-1014. Reasons for formation of the Cartel, countries affected, development in trade of each country, and the Cartel's control of exports are discussed. Ha (15a)

**World Fuel and Heavy Industries.** LEAGUE OF NATIONS REPORT. *Iron & Coal Trades Review,* Vol. 133, Oct. 9, 1936, page 605. Statistics on world industrial activity, prices and production in 1935-1936 for fuels, power and metals. Ha (15a)

**Fuel Industry and Metallurgy in Soviet Russia (Les Industries des Combustibles et la Métallurgie de la Russie-Soviétique)** EUG. PROST. *Revue Universelle des Mines,* Vol. 12, Nov. 1936, pages 460-474. Sources and distribution of oil, coal, wood, minerals and ores are described; statistics on production and consumption, development of mining, dressing and manufacturing methods, and comparison with resources of other countries are discussed. Ha (15a)

**Housing.** L. W. MOFFETT. *Iron Age,* Vol. 139, Jan. 7, 1937, pages 110-117. Tremendous market for dwellings lies ahead, with steel playing an important part. Gives a list of steel house manufacturers listing the number of houses built in 1936 by each, number under construction, kind of steel used, average number of tons of steel used per house, price and other items. VSP (15a)

**Aluminum in the German Metal Industry (Das Aluminium in der deutschen Metallwirtschaft)** H. PRICKS. *Aluminium,* Vol. 18, Dec. 1936, pages 649-652. Statistical. Ha (15a)

**Suppliers of Parts and Products.** FRANK J. OLIVER. *Iron Age,* Vol. 139, Jan. 7, 1937, pages 591-594, 596, 597, 600-602, 605-609. Analyzes some of the problems confronting those fundamental industries that furnish parts on contract to fabricators of completed products, and points out means being taken by them to meet competition. VSP (15a)

**Steel Enters a New Cycle.** C. E. WRIGHT. *Iron Age,* Vol. 139, Jan. 7, 1937, pages 64-81. Statistical review. VSP (15a)

**Platinum Deposits at Birbir, West Ethiopia (Die Platinlagerstätten am Birbir in Westabessinien)** L. VON Z. MÜHLEN. *Metall und Erz,* Vol. 33, July 1936, pages 349-353. Geographic distribution of and production from deposits are described. FPP (15a)

**Metal Mining in Montana, 1936—Advance Summary.** T. H. MILLER. *U. S. Bureau of Mines, Mineral Market Reports* No. M. M. S. 509, Jan. 18, 1937, 2 pages. Statistical. AHE (15a)

**Copper Industry in 1936—Advance Summary.** H. M. MEYER. *U. S. Bureau of Mines, Mineral Market Reports* No. M.M.S. 520, Jan. 19, 1937, 3 pages. Statistical. AHE (15a)

**Black and Galvanized Sheets.** SPENCER SUMMERS. *Times [London] Trade & Engineering,* New Series, Vol. 40, Dec. 1936, page 15. *Iron & Coal Trades Rev.,* Vol. 134, Jan. 15, 1937, pp. 120-121, 124. Discusses trade, particularly in England, and tabulates British production for 1934-1936. MS + Ha (15a)

**Consumption of Primary and Secondary Tin in the United States in 1935.** E. W. PEHRSON, JOHN B. UMHAU & M. E. TROUGHT. *U. S. Bureau of Mines, Information Circular* No. 6930, Nov. 1936, 12 pages. Statistical. AHE (15a)

**Zinc Industry in 1936—Advance Summary.** ELMER W. PEHRSON & H. M. MEYER. *U. S. Bureau of Mines, Mineral Market Reports* No. M.M.S. 515, Jan. 15, 1937, 2 pages. Statistical. AHE (15a)

**Tin Plate.** *Iron Age,* Vol. 139, Jan. 7, 1937, pages 135-137. Cold reduced Sn-plate is displacing hot mill plate as present capacity climbs to 30% of country's total facilities with a 42% increase in sight by end of 1937. Includes a table giving an analysis of present hot and cold Sn-plate capacity and cold reduced capacity under construction. VSP (15a)

**Scrap.** *Iron Age,* Vol. 139, Jan. 7, 1937, pages 142-144. Scrap consumption in 1936 totaled about 35,600,000 tons of which about 17,500,000 tons were purchased and the rest company scrap. Export shipment of scrap for the past year totaled about 1,955,000 tons and valued at $24,000,000. This great demand for scrap raised the price from $6.60 a ton in July 1932 to $17.75 in Dec. 1936. Japan imported about 1,500,000 tons of scrap most of which was purchased in the United States. VSP (15a)

**Metal Mining in Utah, 1936—Advance Summary.** C. N. GERRY & T. H. MILLER. *U. S. Bureau of Mines, Mineral Market Reports* No. M.M.S. 508, Jan. 18, 1937, 3 pages. Statistical. AHE (15a)

**Metal Mining in Washington, 1936—Advance Summary.** C. N. GERRY & T. H. MILLER. *U. S. Bureau of Mines, Mineral Market Reports* No. M.M.S. 510, Jan. 19, 1937, 1 page. Statistical. AHE (15a)

**Lead Industry in 1936—Advance Summary.** ELMER W. PEHRSON & H. M. MEYER. *U. S. Bureau of Mines, Mineral Market Reports* No. M.M.S. 519, Jan. 19, 1937, 2 pages. Statistical. AHE (15a)

**World Output.** T. W. LIPPERT. *Iron Age,* Vol. 139, Jan. 7, 1937, pages 146-149. Armaments and post-depression requirements aided the steel industry in establishing an all-time peak production level in 1936, with total output of ingots and castings estimated at 119,550,000 tons. Of the total amount United States accounts for 41%, Germany 16% and Russia 14%. Includes tables showing world production of ingots and castings, and pig Fe by countries for 1913 and 1928-1936. VSP (15a)

**Iron and Steel in the South.** LEWIS JONES. *Times* [*London*] *Trade & Engineering,* New Series, Vol. 40, Dec. 1936, page 15. Deals with steel industry of South Wales and describes recently completed Cardiff-Dowlais Works and proposed new plant of Messrs. Richard Thomas & Co., which will have first continuous strip mill in the country. District produced 1,881,000 tons of steel ingots in 1935—19% of total British output. 67% was rolled into Sn-plate and sheet bars. Sn-plate-bar industry is situated mainly in western part of South Wales. MS (15a)

**Metal Mining in Colorado, 1936—Advance Summary.** CHAS. W. HENDERSON & A. J. MARTIN. *U. S. Bureau of Mines, Mineral Market Reports* No. M.M.S. 503, Jan. 11, 1937, 11 pages. Statistical. AHE (15a)

**Metal Mining in Texas, 1936—Advance Summary.** CHAS. W. HENDERSON & A. J. MARTIN. *U. S. Bureau of Mines, Mineral Market Reports* No. M.M.S. 513, Jan. 19, 1937, 1 page. Statistical. AHE (15a)

**Metal Mining in New Mexico, 1936—Advance Summary.** CHAS W. HENDERSON & A. J. MARTIN. *U. S. Bureau of Mines, Mineral Market Reports* No. M.M.S. 512, Jan. 19, 1937, 3 pages. Statistical. AHE (15a)

**Presses and Sheet Metal Machinery.** O. P. HATTON. *Iron Age,* Vol. 139, Jan. 7, 1937, pages 381-389; Jan. 14, 1937, pages 46-51, 104, 106. Discusses the improvements in hydraulic as well as mechanical presses, use of high speed dies, minimum quantity production, low cost dies, control equipment and a number of related subjects. VSP (15a)

**Cadmium Industry in 1936—Advance Summary.** ELMER W. PEHRSON & H. M. MEYER. *U. S. Bureau of Mines, Mineral Market Reports* No. M.M.S. 521, Jan. 19, 1937, 1 page. Statistical. AHE (15a)

**Metal Mining in Arizona, 1936—Advance Summary.** C. N. GERRY & PAUL LUFF. *U. S. Bureau of Mines, Mineral Market Reports* No. M.M.S. 507, Jan. 16, 1937, 4 pages. Statistical. AHE (15a)

**Refining Nickel at Clydach.** D. OWEN EVANS. *Times* [*London*] *Trade & Engineering,* New Series, Vol. 40, Dec. 1936, page 19. Gives production statistics of Mond Nickel Co. refinery, and discusses relations with employees and value of research in expanding markets. MS (15a)

**Steel Production in Turkey.** *Engineer,* Vol. 162, Dec. 25, 1936, page 689. A new Fe and steel center is being established in Turkey with the help of the London firm of H. A. Brassert and Co. It is hoped that Turkey will become independent of foreign imports of Fe and steel and that production will be sufficient to repay the London firm through imports. LFM (15a)

**International Steel Relationships.** *Engineer,* Vol. 162, Nov. 13, 1936, pages 521-522. Editorial commenting on the present amicable relations brought about in the world's steel industries through the activities of the European Steel Cartel. Japan and Russia, both outside the Cartel, are the only countries liable to cause concern. LFM (15a)

**Steel Trade and Exports.** *Engineer,* Vol. 162, Nov. 20, 1936, page 549. Editorial commenting on remarks made at the London Iron and Steel Exchange dinner concerning Britain's export and import trade. At the present time the home market is using all the steel produced and there is a demand for more. LFM (15a)

**The Japanese Steel Industry.** *Engineer,* Vol. 162, Dec. 11, 1936, page 627. The Japanese Government is trying to develop the Fe and steel industry so that imports will be unnecessary. The great difficulty is the scarcity of raw materials. Production figures of the Nippon Iron Co. which produces 95% of the total output of pig Fe are given. LFM (15a)

**Copper Consumption in the United Kingdom.** *Electrical Review,* Vol. 119, Nov. 13, 1936, page 694. Abstracted from a review by the British Metal Corp. Estimated consumption of primary Cu in 1935 was 240,000 tons. Consumption for 1936 will probably be 250,000 tons. Production of secondary Cu was 65,000 tons in 1933, and 70,000 tons in 1934. In 1934, secondary Cu furnished ¼ of total consumption. Electrical industry took ⅔ of unalloyed Cu used industrially in 1933 and 1934, and ½ of all Cu, including alloys. MS (15a)

**Applying Wage Incentives to Steel Mill Maintenance Crews.** B. S. BURRELL. *Steel,* Vol. 99, Dec. 28, 1936, pages 36-38. Paper read before Industrial Management Society, Chicago. Describes experience of Inland Steel Co. Bonus incentive method of wage payment was considered responsible for about 40% of reductions made in maintenance and repair costs since 1924. MS (15a)

**Tinplate Trade.** W. ROBSON BROWN. *Times* [*London*] *Trade & Engineering,* New Series, Vol. 40, Dec. 1936, page 19. Discusses conditions in the industry, with special reference to Great Britain. Expansion in canning industry should prove to be beneficial. Includes statistics. MS (15a)

**Metallurgical Reminiscences.** ALBERT SAUVEUR. *Iron Age,* Vol. 138, Oct. 29, 1936, pages 34B-34D. Abstract of paper read before the Institute of Metals and Iron and Steel divisions of the American Institute of Mining and Metallurgical Engineers at the National Metal Congress in Cleveland. VSP (15b)

## 15b. Historical

**Metallurgical Progress—A Broad Survey of the Vast Nonferrous Field Shows Many Changes.** ERNEST A. HERSAM. *Eng. Mining J.,* Vol. 138, Feb. 1937, pp. 90-96. An historical review. WHB (15b)

**Fifty Years of Successful Diversified Efforts.** *Iron Age,* Vol. 139, Feb. 4, 1937, pp. 72-73. Discusses the 50 yrs.' progress of Kane and Roach, Syracuse, N. Y., manufacturers of metal working equipment. VSP (15b)

# Book Reviews

## AN INTRODUCTION TO THE METALLURGY OF IRON AND STEEL. 2D EDITION.

**H. M. Boylston.**

*John Wiley & Sons, Inc., New York, 1936. Cloth, 6 x 9¼ in., 563 pages. Price $5.00.*

This second edition represents a fairly extensive revision of Professor Boylston's book, which first appeared in 1927. Recently developed equipment and processes are described and all statistical tables and charts have been brought up to date. The first 72 pages treat the historical development, economics and raw materials of the iron and steel industry. Following this come 54 pages on the blast furnace and its products; 58 pages on iron and steel foundry practice; a short section on wrought iron including a description of the Byers-Aston Process; 150 pages on steelmaking and ingot practice; and short sections on the mechanical working and the metallography of steels. The illustrations and charts show careful selection by the author and were reproduced in an excellent manner by the publisher.

For use as a text in a junior or senior course in ferrous metallurgy in an engineering school, the book has the following shortcoming: It does not apply the previous training of students in chemistry, physics and mathematics to the treatment of the physical chemistry of blast furnace reactions, the burdening of furnaces, material and heat balances on processes and the physical chemistry of steelmaking.

This book offers an excellent descriptive outline of the iron and steel industry which should be helpful to the beginner, especially to the young man who enters the industry without previous scientific training.—J. C. WARNER.

## ELECTRONS (+ and −), PROTONS, PHOTONS, NEUTRONS AND COSMIC RAYS.

**Robert A. Millikan.**

*Univ. Chicago Press, Chicago, 1935. Cloth, 5 x 7½ in., 492 pages. Price $3.50.*

This is essentially a revision and amplification of Professor Millikan's well-known work "The Electron," published first in 1917. The great amount of work which has appeared in this field during the intervening years, including a number of discoveries of fundamental importance—the neutron, for example—is recounted here in historical and extremely entertaining form. Professor Millikan writes in a most engaging fashion as an active participant discussing the circumstances that led to earlier work, particularly his own work on the determination of the elementary charge *e*, in such a way that the document of scientific advance is presented as a living account.

Those metallurgists who are interested in science for its own sake will certainly enjoy and profit from this book—R. F. MEHL.

## THE METALLURGY OF GOLD. 7th Edition, Revised.

**Thomas Kirke Rose and W. A. C. Newman**

*J. B. Lippincott Co., Philadelphia, 1937. Cloth, 6¼ x 9 in., 561 pages. Price, $15.00.*

The last edition of this standard work appeared 20 years ago. The changes occurring in the interim have necessitated an entire rewriting, with elimination of extended comment on obsolete processes and inclusion of much new matter. The authors, connected with the British Mint, are of course in position to write authoritatively. The book is not only authoritative but extraordinarily comprehensive. It covers the properties of the metal, discusses the alloys and the chemistry of gold compounds in the first 80 pages, then turns to mining, crushing and grinding, amalgamation, gravity concentration, flotation, and roasting. About 150 pages are then devoted to cyaniding. Testing and assaying of ores and bullion and the melting and refining of bullion complete the subjects.

The physical metallurgy of gold alloys, to which but 46 pages are given, is more fully treated than the space would indicate. Though only the Au-Cu, Au-Ni, Au-Pt, Au-Ag, Au-Te, Au-Sn and Au-Zn equilibrium diagrams are shown, the other alloys are described in the text and their workability indicated. Gold solders, white and green golds are discussed briefly, from the point of view of use in jewelry. Dental uses are hardly mentioned.

In the discussion of grinding and concentrating, several new devices that have gone into service only in the last few years are described along with the venerable ones. The book is excellent in its concentration treatment. It specifically mentions advantages and disadvantages of various devices, as well as the current extent of their use. Instead of falling into the pit of trying to describe "*the* flotation theory," this book simply lists five popular theories. In respect to cyaniding the extraordinarily dilute solutions used as compared with leaching of base metal ores impresses the reviewer who is blissfully ignorant of cyanide practice. The vacuum extraction of dissolved air so that dissolved oxygen in the solution will not interfere with the precipitation of Au by Zn dust, and the selective adsorption of Au from solution by charcoal are also interesting, to say nothing of vacuum distillation as applied to cyanide recovery. Indeed, with the discussion of filtration, the book would be interesting collateral reading for a course in chemical engineering.

The examples of practice at different mines all over the world emphasize how much each ore is an individual problem and indicate the need for a thorough understanding of fundamentals in many varied lines of engineering by operators in out-of-the-way places. The availability of the book in its modern, revised form will be a boon to such operators. Metallurgists who do not regularly deal with gold will find the book a primary source of information when they do need information on it.—H. W. GILLETT.

## THE MINERAL INDUSTRY DURING 1935. VOL. 44.

**Edited by G. A. Roush.**

*McGraw-Hill Book Co., Inc., New York, 1936. Cloth, 6¼ x 9¼ in., 754 pages. Price $12.00.*

This volume supplements the previous 43 issues in that it brings up to date statistical and general information, including some technology and trade. There are 42 contributors usually well-informed in the respective fields which they discuss. Most of the metals and minerals are covered. Of value to many are sections including tables of value of Foreign Coins, the State Geological Surveys, Trade Associations of the United States, Professional Organizations of the United States and Canada and Current Tariff Rates on Minerals and Metal Products.—E. F. CONE.

## THE TECHNICAL KNOWLEDGE OF SURFACES *(Technische Oberflächenkunde)*

**Gustav Schmaltz**
*(Tech. Hochschule, Hanover)*

*Julius Springer Verlag, Berlin, 1936. Paper, 6¾ x 10 in., 286 pages, 295 figs. Price 45.6 RM.*

Besides his professorial connection, the author is a member of a firm of machine tool builders. The book bears evidence of years of study of finish of machined surfaces from both the theoretical and the practical points of view. It is very rich in foot-note references, particularly in respect to the physics of the subject. The table of contents is accompanied by signs showing which sections are of importance to, or can be omitted by, advanced students, constructors, workmen and testing engineers. The marks in the column for the testing engineer outnumber the rest; that is, the book is primarily written for those who wish to evaluate the roughness or smoothness of a surface. Among the methods of evaluation described are: touch, the naked eye, reflection methods, microscopic examination and photography, with emphasis on lighting, light interference, needle-point traversing and multiplication methods with their limitations, integration methods, electron scattering and the possible utility of the electron-microscope. Much attention is given to the work of Abbott and Firestone.

The discussion of surfaces obtained by machining, grinding and lapping includes a consideration of the mode of chip formation, chatter, and cold working of the surface. Drawn, extruded and pressed surfaces and stretcher strains are also dealt with.

Perhaps the most interesting part of the book to the metallurgist is the one dealing with effect of surface finish on endurance, on Griffith's theory of submicroscopic fissures, the connection between surface finish and bearing friction and wear, rubbing corrosion, lubricant adsorption, press fits and microplastic deformation. The sections on effect of surface roughness on flow of liquids, on emissivity, on thermal contact and on condensation and vaporization are of general engineering interest. The book closes with a discussion of standardization of finishes. It is well printed and illustrated. The profuse use of italics brings out the points the author wishes to emphasize. It is rather expensive but should interest quite a group of readers, including machine shop men, physicists and metallurgists.—H. W. GILLETT.

## ORIENTAL ALCHEMY. Masumi Chikashige.

*Rokakuho Uchida, Tokyo, 1936. In English, cloth, 5¼x7¾ in., 102 pages. Price 1.50 yen.*

Ancient Chinese recipes for making gold are examined, under the assumption that one of the nine ingredients was a gold-bearing ore, the others serving as fluxes. The author says, in reference to a museum specimen of this ingredient, "Although we must not be irreverent enough even to think of analyzing it, since it is an Imperial Possession, I have ventured with deep respect and actuated solely by my humble desire to benefit science, to wonder whether the secret key of alchemy could possibly be hidden in it."

In the Chou dynasty, about 1000 B.C., six recipes for bronze were given stating ratios of copper and tin for making various objects. Assuming that the tin was impure, these ratios figure out not far from those of present metallurgy. Analyses are given of many ancient objects. Some of the old coins contained as much lead as copper; the author thinks this was due to liquation.

Japanese sword blades are discussed and illustrated. A high carbon layer was folded over and welded onto a soft steel core. The author connects the present military power of Japan with the existence of high grade swords in the days prior to fire arms.

The translation, done by Sasaki, is excellent. The contents are metallurgical rather than chemical. Any metallurgist with an antiquarian leaning will find the book interesting.—H. W. GILLETT.

## MODERN STEEL FOUNDRY *(Moderne Stahlgiesserei)*

**B. Osann.**

*Julius Springer Verlag, Berlin, 1936. Cloth, 6½ x 10 in., 261 pages. Price 26.70 RM.*

This book is intended primarily as a reference book for the steel foundry metallurgist. However, the material is presented in a manner that makes the book interesting and valuable even to those not connected with the steel foundry. It should be an excellent source of information to the student desiring knowledge of the construction of the open hearth, converter, electric arc, induction furnaces and various auxiliary equipment necessary for the operation of furnaces.

The author has been brief and concise in his presentation of the subject matter, but the scope of the book is too broad to permit discussion of the many details of the various practices involved. Over half of the book is devoted to a discussion of steel making practices encountered in the steel foundry. These cover the crucible, acid and basic open hearth, converter, acid and basic electric arc, and the induction furnace methods of steel making. The construction of the furnaces and auxiliary equipment for the various practices is discussed in detail with a meager discussion of the metallurgical principles involved. The elimination of the various metals and metalloids in acid and basic practice are discussed in relation to the open hearth and electric arc processes.

The physical properties of unalloyed and alloyed steel castings are covered in 50 pages. The alloy castings discussed are: manganese steels 7-20%; silicon steels 1-16%; nickel steels 1-3%; chromium steels 1-34%. Copper, molybdenum, vanadium, tungsten and titanium alloy steel castings are discussed briefly.

The rest of the book is a discussion of the preparation and finishing of the casting.—D. L. MCBRIDE.

## THE AMERICAN YEAR BOOK

**Wm. M. Schuyler and Albert B. Hart, Editors**

*Thomas Nelson and Sons, New York, 1937. Cloth, 8 x 5½ in., 940 pages. Price $7.50.*

This volume presents a complete, concise (despite its thickness) survey of progress and developments in twenty-seven major fields of national activity in 1936. 150 authorities have contributed individual chapters on the subdivisional phases, which include literally everything from the rise of the C. I. O. to fundamental advances in nuclear physics. Developments in the Mineral Industries are reported for Gold and Silver by Charles W. Henderson; for Iron and Steel by Edwin F. Cone; and for Non-Ferrous Metals by Walter R. Ingalls. Brief chapters on Physics and Physical Chemistry, Electrodeposition and Electric Furnace Products offer necessarily sketchy commentaries on progress in these fields. Engineering educators may be interested in the chapter on Education for the Professions, by Alonzo F. Meyers, which recounts chiefly the activities of the Engineering Council for Professional Development, and will be gratified by Robert Lincoln Kelly's succinct reporting of engineering education's answer to President Roosevelt's charges that it has failed, by inadequate liberalization, to recognize modern social and cultural requirements. For statistically minded commercial steel men, a day by day account of price and operating developments in the industry may be found in the Chronology of Financial Events, taken from the Annual Issue of the *N. Y. Times*.

To metallurgists as such, the book is certainly not worth its price, but to any such desirous of having at first hand a classified, authoritative record of annual developments in all phases of American activity, it can heartily be recommended.—FRED P. PETERS.

## TECHNICAL IRON AND STEEL.
*(Das Technische Eisen)*

**P. Oberhoffer**

*Improved and enlarged by*

**W. Eilender and H. Esser.**

*Julius Springer Verlag, Berlin, 1936. Cloth, 6½ x 10 in., 640 pages. Price 57 RM.*

This is a completely revised edition of Oberhoffer's famous book which last appeared in 1925. While much of the general scheme of the original book has been retained, some change in organization has been thought advisable. New chapters appear on the constitution of binary and ternary alloys, flakes in steel, precipitation and nitride hardening, and the chapters on gases in steel, deoxidation, influence of temperature on properties, red-shortness, cold deformation, recrystallization, and hardening have been completely revised. The extensive bibliography (approximately 1500 references) has been taken up to the middle of the year 1935 and partly to the end of 1936; we may thus assume the subject matter to bear this date also.

The chapter on the constitution of iron and iron alloys is given 260 pages. Thirty binary systems are discussed and in nearly every case also the ternary system with carbon; appended to each system is a discussion of the physical and technical properties pertaining to that system and of the applications of the alloys. This chapter also includes a discussion of gases and inclusions in steel and of the deoxidation of steel. A brief chapter, 20 pages, is devoted to the influence of temperature on the properties of steel, followed by a long (273 pages) and very complete chapter on the effect of treatment on the structure and the properties of steel, including a discussion of primary (ingot) crystallization and segregation, recrystallization at the critical points, cold work and annealing, hardening, precipitation hardening, and surface hardening, (carburizing, nitriding and cementation with metals). Cast irons are treated in three chapters totalling 51 pages.

This reviewer has noted very few errors indeed, though doubtless some are present (as in any book). The $Ac_3$ temperature is given as 906° rather than 910°, the better value. Some omissions in references may be found: the work of Walters and his associates on the constitution of Fe-Mn and Fe-Mn-C alloys is not mentioned; the references are predominantly German, occasionally to a degree to distort the historical development of the subject, as in discussing the atomic mechanism of the formation of martensite. Better differential dilatometer curves are available for pure iron than that given in Fig. 9; the treatment of gas-metal systems, particularly Fe-O, Fe-C-O, Fe-N, would be more useful if p-t and some p-x diagrams had been employed—carburization, for example can only be understood on the basic of such diagrams. The treatment of hardening is excellent, though the Bain hardening diagram should by all means have been included, for it represents the phenomena involved in hardening more clearly than may be done in any other way. American readers may wish for a more complete treatment of austenite grain size and abnormality. But all these comments are not greatly important, for in many instances they merely represent the reviewer's opinions on wholly debatable points.

It is impossible to review this book adequately. It is by all odds the most complete and the most valuable book on iron and steel in existence. It does not suffer by omission of important chapters, as so many books do on this subject. Who masters the book will be "fully trained," not a narrow specialist on the subject—he will be aware of the practical as well as the theoretical aspects of iron and steel.

The book is beautifully printed and the illustrations are excellent. The price, unfortunately, places the book beyond the reach of most interested readers.—R. F. MEHL.

## GRINDING AND POLISHING.
*(Schleifen und Polieren)* **3D EDITION.**

**B. Buxbaum**

*Julius Springer Verlag, Berlin, 1937. Paper, 6¼ x 9 in., 68 pages. Price 2 RM.*

This, the 3d edition of No. 5 of "Werkstattbücher," (some 14,000 copies of earlier editions having been distributed) is a general discussion relating more to grinding than to polishing. Sources, composition and nature of natural and artificial abrasives including diamond and boron carbide, tumbling, belt grinding, lapping, wheel polishing, abrasive wheels bonded with ceramic materials, plastics, or Sorel cement are discussed.

Shapes of grinding wheels are illustrated and hones described. The mounting of wheels, their grain size and porosity, hardness and its testing (e.g. by sandblasting) are given attention. Permissible speeds and feeds in machine grinding are tabulated and cooling media discussed, as are mounting and use of diamonds for dressing and truing. The ratio between stock removed and loss of weight of the grinding wheel is an index of the correctness of choice of wheel and grinding methods for a given material. Commercial sizes of German wheels are listed and various causes of poor work discussed.

The pamphlet is written from the point of view of the grinding wheel and the mechanical engineer; the material cut and the things in which the metallurgist is interested are not given much attention. —H. W. GILLETT.

## PHOTO-ELASTICITY STUDIES
*(Festigkeitslehre mittels Spannungsoptik)*

**Ludwig Föppl and Heinz Neuber.**

*Verlag R. Oldenbourg, Munich-Berlin, 1935. Board, 5½ x 8½ in., 115 pages, 80 figures. Price 6.60 RM.*

This authoritative, beautifully printed but inexpensively bound little book deserves the highest praise as an introduction, for those with the requisite mathematical training, to the science of stress-optics as applied to the distribution of stresses in structural members and machine parts. It deserves translation, or better yet, a similar work in English with a little expansion of some parts which seem to the reviewer a bit too concise for metallurgists.—M. GENSAMER.

## MANUAL OF PRACTICAL MATERIALS - INSPECTION IN THE METAL INDUSTRIES *(Hilfsbuch für die praktische Werkstoffabnahme in der Metallindustrie)*

**E. Damerow and A. Herr.**

*Julius Springer Verlag, Berlin, 1936. Paper, 6½ x 9⅞ in., 80 pages. Price 9.60 RM.*

This book was intended as a manual for the testing laboratory and inspection department. Nineteen pages briefly cover the handling of test specimens in the tensile test, the hardness tests of Brinell, Rockwell, Vickers, Shore and scratch method, as well as the notch toughness test and the testing of welds. The remainder of the book has forty-two pages for calculating (in metric units) stress, elongation, reduction of area, hardness, relation of the various hardness values to each other, a few physical constants and English-metric conversion factors. The book will be of assistance to test engineers and inspectors.

The reviewer did not check the values contained in the various tables, but in glancing over them noticed on page 79 an obvious error in reporting a long ton as 3,240 lbs.—RICHARD RIMBACH.

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# Current News Items

## Conference of Open-Hearth and Blast Furnace Operators

The annual conference of the Open-Hearth Committee of the American Institute of Mining and Metallurgical Engineers was held this year at Birmingham, Ala. The Blast Furnace and Raw Materials Committee of the Institute joined with the other committee so that a large conference resulted. The total attendance was over 450, with about 225 credited to the Open-Hearth Committee. The attendance at the latter committee's conference in Detroit in 1936 was 258 and at the 1935 meeting in Cincinnati it was about 215. It had been 10 yrs. since the two groups had met together.

The technical programs of the two committees were carried out on April 7 and 8 at the Hotel Tutwiler with one joint session on Wednesday, April 7. Each session was devoted to a few papers and to general discussions from the floor on problems relating to open-hearth and blast furnace problems. They were all successful and profitable.

A feature of the joint meeting of the two groups was a trip to the Fairfield and Ensley plants on Friday, April 10, of the Tennessee Coal, Iron & Railroad Co., a subsidiary of the United States Steel Corp. Lunch was served to about 350 guests at the Fairfield plant. The hospitality of the local committee was a feature of the combined conference.

The 1938 conference of the Open-Hearth Committee will be held in Buffalo in April. It is not unlikely that the Blast Furnace Committee will also join.

The present officers of the Open-Hearth Committee were re-elected for the ensuing year: L. F. Reinartz, chairman; C. E. Williams, secretary; J. T. Bruenich, executive secretary.

## Gear Makers' Annual Convention

Papers relating to gear design, foundry practice, and plant management have been planned for the 21st annual meeting of the American Gear Manufacturers Association, to be held at the Galen Hall Hotel, Wernersville, Pa., May 24-25. They will include:

"Application Factors for Helical and Herringbone Speed Reducers," by S. L. Crawshaw, application engineer, Westinghouse Nuttall Works; "Automobile Transmissions," by J. O. Almen, dynamics division, Research Laboratories, General Motors Corp.; "Meehanite Iron," by O. Smalley, president, Meehanite Institute of America; and "Casting Steel in Concrete Molds," by H. F. Scatchard, Birdsboro Steel Foundry & Machine Co.

Also, "Plant Management," by N. M. DuChemin, assistant manager, West Lynn works, General Electric Co.; "Wage Incentives," by Neal Foster, Boston Gear Works, Inc.; "Foremen and Foremen's Training," by H. H. Kerr, president, Boston Gear Works, Inc.; and "Credit Unions," by E. S. Sawtelle, vice-president and general manager, Tool Steel Gear & Pinion Co., and president of the A.G.M.A.

J. C. McQuiston, Penn-Lincoln Hotel, Wilkinsburg, Pa., is manager-secretary of the association.

● The annual meeting of the Gray Iron Founders' society will be held at the Hotel Cleveland, Cleveland, Friday and Saturday, June 11 and 12. Further details of the program will be announced later.

● A Directory of Members has been issued by the Gray Iron Founders' Society, Inc., Cleveland, which, as of Feb. 1, 1937, gives an alphabetical index and arrangement of gray iron foundries by states.

## Convention of Purchasing Agents

Some of the nation's outstanding industrial leaders will lead discussion on 14 commodities, including steel, coal, petroleum, aluminum, copper, lumber, tin, lead, zinc, refractories, coke, paint, glass and paper, at the twenty-second international convention of the National Association of Purchasing Agents to be held in Pittsburgh May 24 to 27, according to Thomas D. Jolly, chairman of the program committee.

Speakers and their subjects which have been made public are: "Coke and Other By-Products of Coal" by C. J. Ramsburg, vice president of the Koppers Co., Pittsburgh; "Petroleum and Its Products" by Dr. Paul D. Foote, executive vice president of the Gulf Research and Development Corp., Pittsburgh; "Refractories" by John D. Sullivan, chief chemist of the Battelle Memorial Institute of Columbus, O.; "Aluminum" by S. K. Colby, vice president of the Aluminum Co. of America, Pittsburgh; "The Steel Industry" by J. H. Van Deventer, Editor of *The Iron Age;* "Copper" by Albert E. Petermann, vice president of the Calumet & Hecla Consolidated Copper Co. of Michigan, New York City; "Lumber" by Henry J. Eckstein, president of Foresta Factors, Inc., New York City; "Tin, Lead and Zinc" by C. S. Trench, editor of the *American Metal Market,* New York City.

## New Policy of Wire Association

*Wire & Wire Products* has modified its editorial policy to include a separate department of the magazine called "Springs and Wire Products" under the editorial and engineering direction of J. W. Rockefeller, Jr.

The Wire Association also announces the organization of a new division of the association, devoted to the Cold Working of Metals and Finished Products. The chairman is B. L. McCarthy. The chairman of the organization and membership committee is A. R. Zapp of Firth-Sterling Steel Co.

## New Officers of Tool Engineers

Frank A. Shuler, master mechanic, Highland Park plant of the Chrysler Corp., has been elected national president of the American Society of Tool Engineers. Luke E. Beach, assistant master mechanic, Packard Motor Car Co., is first vice-president and Walter Wagner, master mechanic, Lincoln Division, Ford Motor Co., is second vice-president. C. Ray Brunner, of the tool engineering department, Dodge Brothers Corp., remains as secretary and Frank R. Crone, tool engineer, Lincoln Division, has been re-elected treasurer.

## Dust Control Equipment Association

Arthur J. Tuscany, executive secretary-treasurer of the Dust Control Equipment Association, announces that the organization at its recent meeting selected officers as follows: President, H. B. Loxterman, Blaw-Knox Co., Pittsburgh; vice president, M. A. Eiben, Northern Blower Co., Cleveland; executive secretary-treasurer, Arthur J. Tuscany, Cleveland.

Announcement is also made of the appointment of an engineering committee, one of whose principal duties will consist of the development of standards of dust control practice. The need for such recognized practices has existed for some time. The engineering committee will also be available for consultation by other associations or groups interested in preparation of codes, developments of regulations and the like.

The offices of the association are located in the Penton Building, Cleveland.

## A Portable X-Ray Unit

The latest development of the St. John X-Ray Service, Inc., Long Island City, N. Y., is a portable X-ray unit mounted on a trailer chassis. It is called "The Modern Covered Wagon which

is blazing new trails in industry." The machine is described as powerful enough to penetrate 3 in. of steel in a 1-min. exposure, and as particularly suitable for field inspection.

## Noted Scientists Help Dedicate New Home of Mellon Institute

Internationally known scientists took part in the program of Mellon Institute, Pittsburgh, when its new building was dedicated May 5 to 9. They included four Nobel laureates, as well as other nationally recognized figures in chemistry, medicine and other sciences.

At the formal dedication of the building in the afternoon of May 6 in Carnegie Music Hall, with Dr. Weidlein presiding, addresses were given by three Nobel prize-winners—Dr. Irving Langmuir (chemistry), Dr. H. C. Urey (physical chemistry), and Dr. W. P. Murphy (medicine). Brief addresses were also made at this event by Andrew W. Mellon and Richard K. Mellon, representing the founders.

The Trustees' dinner, in the evening of the same day, had among the speakers Dr. Benjamin T. Brooks, Dr. Karl T. Compton, and Dr. F. C. Whitmore, A. V. Davis, chairman of the board of the Aluminum Co. of America, was toastmaster. Trustees of the Institute comprise John G. Bowman, president, Dr. Weidlein, vice-president, Henry A. Phillips, secretary-treasurer, Andrew W. Mellon, and Richard K. Mellon.

The third outstanding scientific event of the dedicatory ceremonies was the Symposium on Recent Progress in Science, on Friday, May 7, in Carnegie Music Hall.

The new building of Mellon Institute, which has taken six years to complete, was dedicated to science and humanity in honor of Andrew W. and Richard B. Mellon, founders of the institution, who in 1911 gave support to the research fellowship system advanced by the late Robert Kennedy Duncan by establishing a specific department at the University of Pittsburgh and in 1913 placed the system on a permanent basis with the organization of Mellon Institute.

## The G-E Machine Tool "Speed" Show

The General Electric Machine Tool "Speed" Show, a traveling presentation of the latest electric equipment for machine-tool application, will open at the Hotel Bancroft in Worcester, Mass. on May 17. The show, which lasts one full day and to which New York and New England machine-tool builders have been invited, will stress the importance of higher production speeds with greater accuracy. It opens with a sound motion picture of modern machines in operation, and includes the presentation of papers by leading machine tool manufacturers and G-E engineers, as well as an exhibit of new General Electric equipment for machine-tool service. The program will also include a presentation by the Carboloy Co.

Other cities to be visited by the show are Cincinnati, May 24, and Rockford, Ill., May 28.

## M.I.T. Separates Mining and Metallurgical Departments

In recognition of steadily expanding scientific knowledge and the prospect of increasingly important developments in industry, the Massachusetts Institute of Technology today announced the division of its Department of Mining and Metallurgy into two distinct fields of professional education.

Beginning next autumn the Department of Mining Engineering will be administered as a separate department under the direction of Prof. W. Spencer Hutchinson, who has long been head of the courses in mining and metallurgy. His department will also include the course in petroleum production. The new Department of Metallurgy will be directed by Dr. Robert S. Williams, for many years professor of physical metallurgy, and will include the course in ceramics.

In announcing this important change in technical education at a meeting of the faculty last month, Dr. Karl T. Compton, president of Technology, said that advances in mining engineering and the significant progress in metallurgy make it desirable to recognize them as separate professional fields, each of great importance and promising in opportunities.

The new department of metallurgy will give special attention to physical and process metallurgy, as well as metallurgical production, the latter being concerned primarily with the economical and statistical functions of the industry. The two former involve application of basic and scientific principles to the production and treatment of metals.

Mining and metallurgy, as well as geology, have been part of the Institute's curriculum since its establishment. Technology was the second American school to graduate mining engineers, following Columbia University by a year in 1868 with its first graduates. The Institute had the first American laboratories in mining and metallurgy, and these became the models which were followed by many other educational institutions. The first lectures in metallurgy were given by Prof. Charles W. Eliot, later to become one of Harvard's most famous presidents. Prof. Robert H. Richards, a graduate of the Institute's first class and its oldest living alumnus, began teaching at the Institute in 1868, the year of his graduation. In 1873 he became head of the department of mining engineering and was in charge until his retirement in 1914.

## Manganese Ore from Cuba

Installation of new equipment at a cost of $500,000 has been virtually completed by the Cuban-American Manganese Corp. at its plant for the processing of manganese ore near Santiago, Cuba, according to Langbourne M. Williams, Jr., president of the American-owned corporation.

Production by improved processes at the Cuban plant is expected to introduce a new factor into the world manganese situation which has been the subject of study by the League of Nations and of important declarations within the last few weeks by the Army and Navy Munitions Board and the Natural Resources Board in Washington, Mr. Williams said.

While officials in Washington were studying the manganese problem, resulting in the listing of the element by the Munitions Board as one of the 23 vitally necessary raw materials in any national emergency, he said, the Cuban-American Manganese Corp., aware of the importance of an adequate, close-to-home supply of manganese, has been speeding completion of its program which will make available to American steel manufacturers the manganese deposits in Cuba, located only 90 miles off the Florida coast.

## "Scrap and America"

A decidedly beautiful and effectively illustrated pamphlet, entitled "Scrap and America," has been issued by an organization known as the Independent Steel and Iron Producers, 60 E. 42nd St., New York. It is designed to forcibly emphasize the point that "excessive exportation of iron and steel scrap is a menace to American national welfare, American labor, American reemployment, American business recovery, American foreign trade, American naval programs, and world peace."

## Recent Patents on the Production and Fabrication of Light Metals

A digest of important developments in the light metal field, as revealed by recent patent literature, is given by Dr. Kurt Nischk in the December 1936 issue of *Leichtmetall*. Specific advances are reported in reduction metallurgy, in new alloys, and in annealing, casting, soldering and welding practices. Aluminum alloys possessing excellent machinability are the subject of 13 patents, all American; almost all of these "machinable" alloys contain more than 6% lead or bismuth, and some copper, in addition to various other elements. Many patents covering solders for light metals, soldering practice, fluxes, and solder-flux combinations are discussed. The most interesting of these is U. S. patent No. 2,052,740, which describes the production of a flux-solder combination by packing the product of reaction between zinc chloride and stearic acid in tin tubes and extruding the whole. New welding rods and fluxes are also covered. The digest includes 22 American, 7 French, 2 British, 2 German, 1 Austrian, 1 Canadian and 4 Swiss patents. The article, written by an adviser to the Reich, reflects the intensive American activity in the light metal field.

## New Heating Element for Electric Furnaces

Announcement is made that Dr. Paul Schwarzkopf, who has assumed the presidency of American Cutting Alloys, Inc., New York, is bringing to this country during the coming year several new developments from his laboratory at Reutte, Austria. One of the most outstanding of these developments is a new element for electric furnaces. This element has been experimentally developed in Reutte, Austria, and has satisfactorily maintained temperatures over 3000 deg. F. One of the experimental furnaces, using several elements, has already exceeded over 900 hrs. at temperatures exceeding 3000 deg. F. and the element maintains a constant resistance with age, but increases its resistance with temperature. This will reduce the control equipment necessary. The new element is a result of many years experimentation with electric furnaces when manufacturing sintered products.

It is anticipated that this new element will widen the field for electric furnaces. One of the experimental furnaces, equipped with the new element, will be brought to this country in May for demonstration and testing by American concerns who are interested.

## Large Orders for Heat-Treating Equipment

That equipment manufacturers are being greatly benefited by the huge production capacity extension being made in the steel industry is indicated by the large contracts for steel mill gas fired heat-treating equipment received by the Surface Combustion Corp., Toledo, Ohio, since the first of the year.

During the month of January, a contract for $191,000 of such equipment was received from the Bethlehem Steel Co. for its Lackawanna, N. Y., plant. This was followed a few days later with a contract for $225,000 covering similar material for its Sparrows Point, Maryland mill. Another outstanding January order was for $299,000 of steel mill furnaces from the Tennessee Coal, Iron & Railroad Co., Fairfield, Ala. An additional contract for $140,000 was received during February from the Sparrows Point plant of Bethlehem Steel Co. Other large February orders were one from the Granite City Steel Co. for $109,000 and one from the Youngstown Sheet & Tube Co. for $108,000.

C. B. Phillips, vice president of Surface Combustion Corp., ascribes the above to the realization by the steel industry that a long era of extensive construction and building work, involving a tremendous demand for steel, can be regarded as a certainty.

● On April 1st, the Driver-Harris Co., Harrison, N. J., announced some changes in their personnel. H. O. Hartdegen, sales engineer, will take charge of the territory comprised of Northern New York State and Eastern Pennsylvania. He will also handle some accounts in the New Jersey territory. This territory was formerly assigned to J. B. Shelby, who has now been advanced to the management of the foundry division where he will act as co-manager with J. Sammon.

## New Plant for the Duraloy Co.

The Duraloy Co., which recently lost its plant at New Cumberland, W. Va. by fire, announces the purchase of the well-equipped foundry owned by the U. S. Pipe & Foundry Co. at Scottdale, Pa., on the Pennsylvania and B. & O. Railroads. This plant is modern and of fireproof construction in every respect and includes, besides up-to-date molding and casting facilities, well-equipped machine and pattern shops, storeroom, testing laboratory, washroom and offices. Every building has a sprinkler system.

Fortunately, the fire at the old plant did not materially damage the electric furnaces, centrifugal casting machines and most of the other equipment. All of this was quickly moved up to Scottdale and, as the power requirements could be fully met, there was little delay in getting into production again. By March 25 the company was able to operate on a full schedule basis, producing chrome-iron, chrome-nickel and nickel-chrome castings, forgings and other shapes and parts.

## New Motion Picture on Hard-Facing

A new motion picture on hard-facing which shows, in detail, the process of adding wear-resisting surfaces to steel parts, is now available for showing to interested organizations or groups. This highly instructive motion picture has been produced by Haynes Stellite Co., a unit of Union Carbide & Carbon Corp. and can be obtained for showings through representatives of either Haynes Stellite Co. or The Linde Air Products Co.

The film begins with a brief description of what hard-facing is and how it is done. The scene then shifts to a series of unique views of the application of Haynes Stellite with the oxy-acetylene flame. The correct manner of applying this cobalt-chromium-tungsten alloy is effectively shown. Following this are views of various industrial applications of hard-facing, such as its use on steam valves for high-temperature, high-pressure service, automotive valve seat inserts, cement grinder rings, and dipper bucket teeth. Throughout the film, emphasis is placed on effective methods of application and the economies resulting from the use of hard-facing.

● The Linde Air Products Co., unit of Union Carbide & Carbon Corp., announces the opening of a new Prest-O-Lite acetylene plant at 2330 Armistead Bridge Road, Norfolk, Va. This plant will take care of the increasing acetylene requirements in the Norfolk area. This brings the total number of Prest-O-Lite acetylene plants serving the oxy-acetylene welding and cutting needs of industry throughout the United States to 53.

● Ralph L. Manier, industrial heat engineer for the Syracuse Lighting Co., Inc., Syracuse, N. Y., has been assigned to the central division staff of the Niagara Hudson Power Co. for coordinating all promotional activities in commercial and industrial heating and air conditioning sales. Mr. Manier is a graduate of Rensselear Polytechnic Institute and has been in charge of the above mentioned activities for the Syracuse Lighting Co., Inc., since 1920. S. W. French of the Syracuse Lighting Co., Inc., succeeds Mr. Manier.

● The American Foundry Equipment Co., Mishawaka, Ind., announces the appointment of Charles Rutledge as service representative for the Detroit district. Mr. Rutledge has had wide experience in service and erection work, and his headquarters will be with Hutton H. Haley & Associates, 2918 East Grand Boulevard, Detroit.

● The Linde Air Products Co. unit of Union Carbide & Carbon Corp., announces the opening of a new Linde oxygen plant on Powhattan Ave., Essington, Pa., near Philadelphia. This plant will take care of the increasing oxygen requirements in the Philadelphia area. This brings the total number of Linde oxygen plants serving the oxy-acetylene welding and cutting needs of industry throughout the United States to 70.

# Personals

## R. J. Wysor Made President of Republic

T. M. Girdler, who has been re-elected chairman of the board of directors of Republic Steel Corp., has announced the election of R. J. Wysor as president of the corporation following a meeting of the board.

A statement by the corporation said: "Mr. Girdler has held both the office of chairman and president for the past six years. He will continue as the chief executive officer of Republic in active charge of all its affairs, and Mr. Wysor will have complete supervision of the affairs of the corporation under his direction. Commenting on Mr. Wysor's election, Mr. Girdler said that "The elevation of Mr. Wysor to the presidency of Republic is a well deserved recognition of the efficient and loyal service rendered to the corporation by him since its formation in 1930."

Mr. Wysor is 51 yrs. of age and has been associated with Republic since its formation in 1930, having been vice president in charge of operations from 1930 to September 1935, and executive vice president and general manager since that date. He has been active in the steel business for the past 31 yrs. Immediately prior to his connection with Republic, he was general manager of Jones & Laughlin Steel Corp., of which corporation Mr. Girdler was then president. When Mr. Girdler resigned to accept the position of chairman of the board of Republic, Mr. Wysor went with him as vice president in charge of operations.

● Dr. George B. Waterhouse, head of the metallurgical division, Massachusetts Institute of Technology, has been elected to the board of directors of the Dominion Steel & Coal Corp., Ltd., and of the Dominion Coal Co., Ltd., Montreal, Canada.

● Harry M. Williams, manager of the standards division, Frigidaire Division, General Motors Sales Corp., has been elected president of the American Society of Refrigerating Engineers.

● A. W. Gregg is again connected with the Whiting Corp., Harvey, Ill., and is serving in the foundry equipment sales division. At one time he was superintendent of the company's foundry department at Harvey.

● Norman C. MacPhee has been appointed metallurgist in charge of electric furnace operations for the Liberty Foundry Co., St. Louis. He formerly was associated with the Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.

● Charles R. Hook, president, American Rolling Mill Co., Middletown, Ohio, has been elected a director of the Rustless Iron & Steel Corp., Baltimore.

● Albert L. Galusha, widely known inventor of the "Galusha Clean Gas Generator," has become associated with The Wellman Engineering Co., Cleveland, as chief engineer of its recently acquired line of Galusha gas equipment. He is located at the company's eastern offices, 30 Church St., New York City.

● The Carboloy Co., Inc., Detroit, manufacturers of cemented carbide tools, dies, and wheel dressers, announces that P. H. Holton has been added to the sales engineering personnel of the Philadelphia territory. Mr. Holton has an exceptionally broad background of experience in the metal working field, having served for over 20 yrs. in sales and production capacities. Mr. Schonberger, formerly of the Philadelphia territory, has been transferred to the Newark office.

● The Lincoln Electric Co., Cleveland, announces the appointment of Don McCormick as arc welding consultant for the Kansas City, Mo., office, at 1818 Main St. Mr. McCormick was formerly welding supervisor for the Sheffield Steel Co., Kansas City, and has had a broad experience in the practical application of electric welding.

● Dr. Ing. Paul Schwarzkopf of Reutte, Austria, well known metallurgist, has accepted presidency of the American Cutting Alloys, Inc., New York City, according to Pierce T. Wetter, vice-president. This completes the reorganization of the company. It now has a Mid-Western Office in Detroit, with J. M. Highducheck, former tool engineer of the Westinghouse Electric & Mfg. Co., as Western manager. The Eastern office is located at 500 Fifth Ave., with George B. Knaepper, mechanical engineer, as Eastern manager. Dr. Schwarzkopf is well known for his pioneering work in the field of powder metallurgy. He invented the titanium cemented carbides for cutting of steel at high speeds.

● The Foxboro Co., Foxboro, Mass., makers of industrial precision instruments, has announced the appointment to the vice presidency of C. E. Sullivan, who has been affiliated with the company for 26 yrs., and has occupied the position of sales manager since 1920. He has been instrumental in the rapid growth of the company and the expansion of its line to include a complete line of indicators, recorders, and controllers for temperature, flow, liquid level, pressure and humidity.

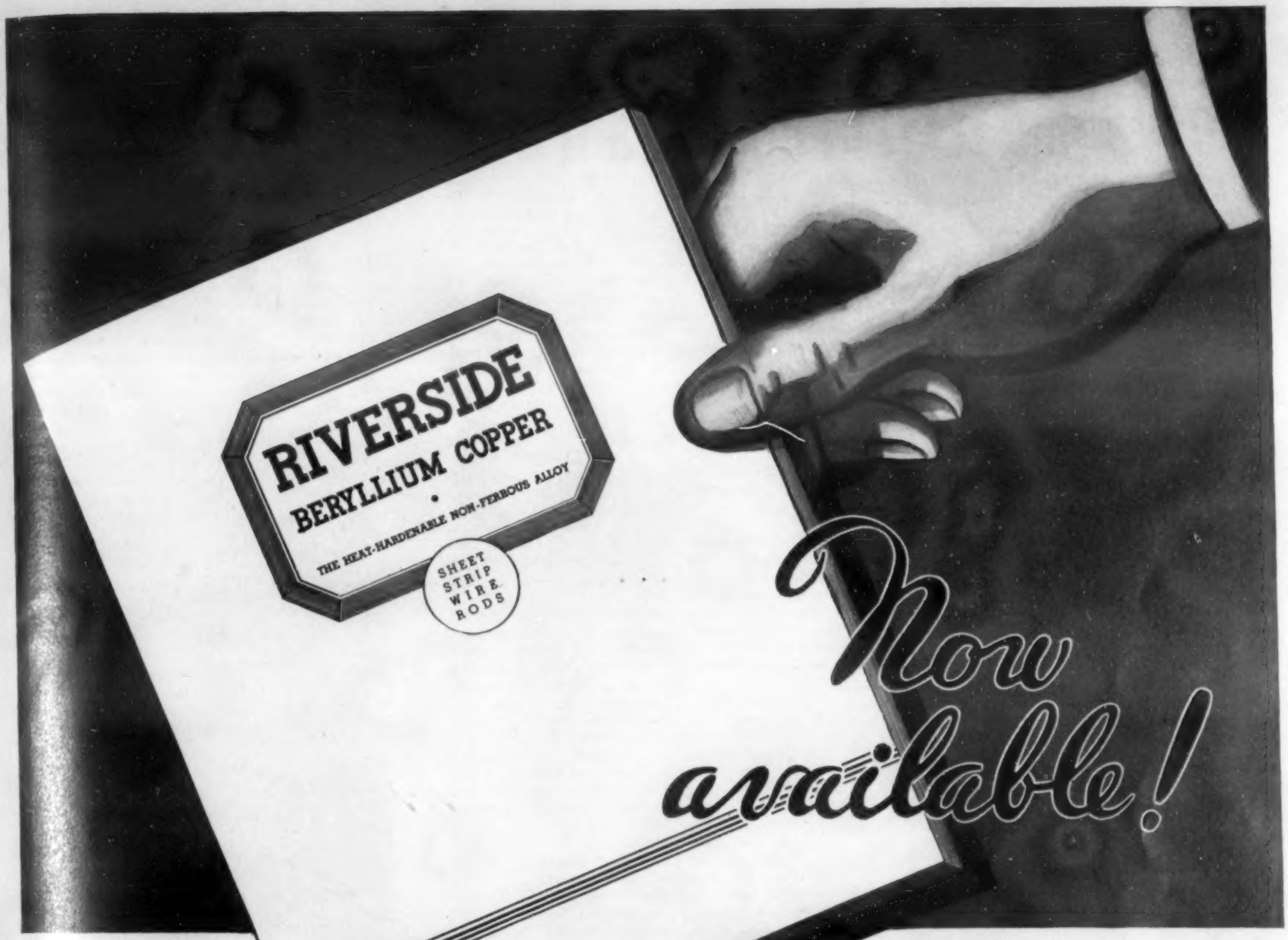
● The Carnegie-Illinois Steel Corp. has announced the appointment of George O. With as manager of sales of the specialty division and concrete bar division in the Chicago district. He first entered the service of the Illinois Steel Co. early in 1933 as sales engineer. In his new capacity, in addition to concrete bars, he will handle sheet piling, bearing piles and "I-Beam-Lok" and "T-Tri-Lok" flooring for the Chicago district.

● Transfer of C. R. Bottenfield, superintendent of the 80-in. and 42-in. mills at the Gary sheet and tin mills of the Carnegie-Illinois Steel Corp. to Alabama, where he will become general superintendent of the new tin mill of the Tennessee Coal, Iron & Railroad Co., is announced. Both companies are United States Steel Corp. subsidiaries. Mr. Bottenfield is succeeded by L. S. Dahl, who up to the present time has served as superintendent of the cold reduction and annealing departments. Harry Gude, assistant superintendent of cold reduction, takes over Mr. Dahl's title and duties, and is succeeded by A. L. Billeter, who has been assistant superintendent in charge of annealing at the sheet and tin mills. Ross O. Laub becomes the new assistant superintendent in charge of annealing.

● E. P. "Ned" Crawford who, for the past 15 yrs. has traveled the Pennsylvania territory in the mill supply and hardware field, has been appointed factory representative in the Pennsylvania territory for the Billings & Spencer Co., Hartford, Conn., manufacturers of forged tools, commercial drop forgings, drop forging hammers and die making machinery. "Ned", as he is familiarily known in the hardware and industrial trade, will make his headquarters in Philadelphia.

● The James F. Lincoln Arc Welding Foundation, sponsor of the $200,000 arc welding prize contest, announces the appointment, as assistant secretary, of Edmond C. Powers who has been engaged for 3 yrs. in technical writing for The Lincoln Electric Co., Cleveland. Mr. Powers has had a broad experience along manufacturing, technical and engineering lines. Prior to starting work with Lincoln, he served the Penton Publishing Co. 4 yrs. as associate editor of two monthly technical publications in the marine field. During the past year, under supervision of A. F. Davis, Lincoln vice president, and with the assistance of various Lincoln engineers, Mr. Powers edited and produced the fourth edition of the Procedure Handbook of Arc Welding Design and Practice.

● The Harnischfeger Corp., Milwaukee, announces the appointment of J. P. Morrissey as head of the weld rod sales division. His practical experience of many years of sales and shop work both in the United States and abroad will undoubtedly prove to be invaluable to his employer. Mr. Morrissey attained nationwide recognition with his interesting article in the *Saturday Evening Post* concerning his experiences as technical welding adviser for the Russian government in 1930. Besides his experience in Russia as supervisor of the welding of locomotives and parts in Voronezh, his former connections also include 6 yrs. as special representative on weld rods with the Crucible Steel Co. of America and some time with the Fusion Welding Corp. as its Philadelphia district manager.




# RIVERSIDE BERYLLIUM COPPER

## A NEW REFERENCE WORK ON THIS HEAT HARDENABLE ALLOY

THIS reference work contains new and up-to-date information on the unusual characteristics of Beryllium Copper gathered from recent metallurgical research and newly developed applications. Helpful data on production, fabrication and heat treatment, together with photographs and outlines of new adaptations, make this booklet valuable to present or prospective users. RIVERSIDE Beryllium Copper is available in sheet, strip, wire and rod.

We will be pleased to send this book to those interested in the present or contemplated use of the remarkable heat-hardenable non-ferrous metal: RIVERSIDE BERYLLIUM COPPER.

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# New Equipment and Materials

## New Electrically-Operated Flow Meter

A new electrically-operated flow meter known as the "Synchro-Meter" has been developed by Bailey Meter Co., Cleveland. Basically, the Synchro-Meter consists of a transmitting unit, which is operated by a Ledoux bell flow measuring mechanism of the type used in standard Bailey mechanically-operated fluid meters, and a receiver consisting of the indicating, recording and integrating instruments. The transmitter is located at the point of measurement of the

variable and the receiver is located at a place or places convenient for obtaining readings from the instruments as frequently as desired.

A number of distinct advantages are claimed to characterize the Synchro-Meter, For example, the transmitter places only a negligible retarding force on the measuring device. Furthermore, the torque developed to operate the receiving element is very large and does not send any reaction back to the transmitter. No adjustments of the Synchro-Meter are necessary at the transmitting end. It may, therefore, be located in a relatively inaccessible place. Several receivers may be operated from one transmitter.

Calibration of the Synchro-Meter transmitting system is simple and permanent. Two scales, one on the transmitter and the other on the receiver, make it possible to test the transmitting system without calibrating the flow measuring element and conversely, to calibrate the flow measuring element without using the electrical system. In the former test, readings at the transmitter and at the receiver are compared while, in the latter, readings are taken directly at the transmitter by means of the indicating pointer provided for that purpose.

Three wires are required to connect the transmitter to the receiver. With the use of No. 12 wire the transmitter may be located approximately one mile from the receiver. If larger wire is used, a greater distance is allowable providing the loop resistance does not exceed 20 ohms. Bailey Synchro-Meters require the use of alternating current at from 95 to 125 volts, and at a frequency of 25, 50 or 60 cycles.

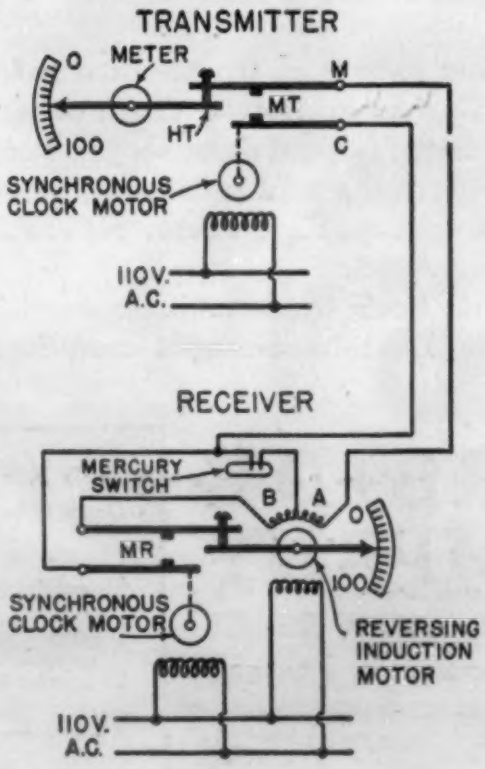
As shown diagrammatically in the wiring diagram, the Bailey Synchro-Meter Transmitter consists essentially of the mechanically-operated measuring device, or meter; two contact arms swinging about points M and C; and a constant speed cam arranged to swing the lower contact arm in a continuous reciprocating cycle. The upper arm is positioned by the flow measuring device through the mechanical stop HT.

The indicating, recording and integrating flow meter receiver operates in a similar manner except that in this case the upper contact arm is positioned by the reversing induction motor. The lower arms in both the transmitter and receiver are caused to rise and fall by means of the identical cams driven by synchronous clock motors.

An induction motor provided with shading coils A and B is the means employed to position the receiver. Short-circuiting one coil produces rotation in one direction, whereas short-circuiting the other coil causes rotation in the other direction. If both coils are short-circuited or open-circuited simultaneously, no rotation results.

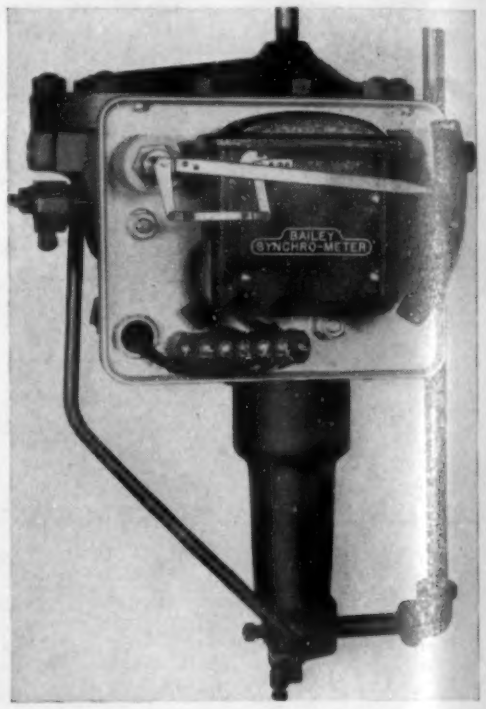
It will be noted that contacts MT in the transmitter are connected to short-circuit shading coil A when the mercury switch is closed, whereas contacts MR in the receiver are connected to short-circuit coil B. If contacts MT and MR close simultaneously no rotation in the reversing motor will take place. This means that the transmitter and receiver are in exact relation with each other.

If the rate of flow decreases contacts MT will be closer together than contacts MR and will close first, short-circuiting coil A, causing counter clockwise rotation of the reversing induction motor until the receiver reads the same as the transmitter. Likewise, if the rate of flow increases, the contacts MT will be farther apart and contacts MR




will close first, short-circuiting coil B, causing rotation of the motor in the receiver in a clockwise direction to show a correspondingly higher meter reading.

The mercury switch, shown in the common line and installed in the receiver Synchro-Meter unit, is closed during the positioning cycle, but is open during the rest of the cycle. Opening of the mercury switch takes place before contacts MT and MR open on the down strokes of the roller arms, thereby preventing arcing or burning upon opening the contacts. In other words, contacts MT and MR close the shading coil circuits, but




never open them. This results in the maintenance of contacts in first-class condition at all times.

In case of power failure, provision is made for automatically re-establishing the proper phase relation between the transmitter cam and the receiver cam so that the Synchro-Meter remains accurate under all conditions.

## Micrometers Tipped with Carboloy

Carboloy Co., Inc., Detroit, manufacturers of cementel carbides, announce a special micrometer tipping service available to all micrometer users. By means of this service, the micrometer user sends his micrometer to the Carboloy company which tips with Carboloy cemented carbides the wear points at the ends of the anvil and spindle. The micrometer is then accurately adjusted and returned to the owner, ready for immediate use.

It is stated that the micrometers will hold to a closer degree of accuracy during a period of use that averages at least 50 times longer life than with regular steel micrometers without Carboloy tips.

Formerly, Carboloy tips were applied principally on micrometers used as "masters" to check other gages. However, because of the new, low price recently established, the use of Carboloy tips on micrometers has been extended to practically all applications. One standard price for tipping all micrometers, regardless of size, has been established. A descriptive leaflet may be obtained by writing the Carboloy Co., at 2985 E. Jefferson Ave., Detroit. [Editor's Note: The new price for tipping all micrometers with Carboloy is $10.00.]

## "Air Draw Furnace"

The "General Air Draw Furnace" of the General Combustion Corp., Chicago, has a wide range of usefulness in the metal processing industry. It is mainly used in the tempering, drawing, and normalizing of small and medium size parts. There are, however, many additional heat treating operations within its temperature range which extend its usefulness. Gas or electric heating is available in all 5 sizes. Air circulation is thorough and effective, reaching all the load, no matter how dense.

Front loading is distinctly advantageous, as

it permits quick and easy handling of all types of charges whether on racks, baskets or ordinary shelves. It is not necessary to pit or offset the shop floor to adapt the unit to production requirements.

The suction heating and circulation system largely eliminates objectionable blasts of heat when the door is opened. A curtain of cold air effectively seals the heat in the oven, due to the fan pulling cold air in, rather than forcing the heat out. Working conditions are consequently improved.

Dense or coarse loads are equally well handled in the General Air Draw. Penetrating heated air is circulated at high velocities, so that temperatures are quickly equalized when the unit is charged. Racks, baskets, or hangers are furnished to suit special requirements. It is available in 5 standard sizes, electric or gas heated, varying from 12 x 18 x 18 in. to 30 x 48 x 24-in. Complete temperature and safety pilot controls are furnished as required.

## Timken Announces Graphitic Steel

A new type of steel, combining the free machining qualities of cast iron with the high strength and response to heat treatment of steel, is announced in a folder on "Graphitic Steel" just issued by The Timken Roller Bearing Co., Canton, Ohio. This new steel is produced for water hardening uses under the trade mark "Graph-sil" and for the oil hardening uses under the trade mark "Graph-mo". Both grades are suitable for dies used in cold working and shaping steel, brass, Dow metal, aluminum, paper and bronze.

Copies of this folder and additional information on the properties and uses of these new steels are available on request to the Steel and Tube Division of The Timken Roller Bearing Co., Canton.

## Skilsaw Slow-Speed Drills

Two new important additions to the well known line of Skilsaw ball bearing electric drills are announced by the manufacturers, Skilsaw, Inc., Chicago.

The new ¼-in. and ½-in. "Slow-Speed, High Torque Shilsaw Drills" have been developed particularly for drilling in steels of high nickel content,—such as Monel and Allegheny metals, stainless steel, etc. The slow speed of these new tools lengthens materially the life of twist drills, eliminating the need for frequent sharpening. Drilling speed, however, is not sacrificed because the high torque features makes it impossible to stall the drills at maximum drilling capacities. The ½-in model is particularly interesting because its design is new for a drill of this capacity. Its one-hand grip feature makes it ideal for close quarter work and for use with hold saws in places impossible to reach with side-handle drills.

Both models are available in speeds of 350, 450, 600 and 750 r.p.m. Their slow speed makes them especially adaptable to wood boring. Smoothness of operation is assured by ball bearings on armature and spindle. Aluminum alloy bodies give strength, durability, and light weight. The ¼-in. drill is 14-in. long, and weighs only 6½ lbs. and sells for $36. The ½-in. drill is 14½-in. long, weighs only 8 lbs. and sells for $48.

## Lammert Air-Cooled Gas Booster

Heretofore the best compressors and gas boosters have been generally water-cooled for continuous work, and the air-cooled ones were used for light or intermittent service.

However, there are times when water is not available, or is expensive to get, and for this service engineers of the Lammert & Mann Co., 221 N. Wood St., Chicago, have designed and added to their line a new air-cooled gas booster. They are so efficiently air-cooled that even when installed in places which are quite warm, they run cool, quiet, and without vibration, making the use of water for cooling entirely unnecessary even for the heaviest work.

In gas boosters it is essential that the pressure be steady at high or light load, and this is accomplished by the Lammert compensator. This booster also cuts the power cost. When the discharge of the compressor is reduced, the motor is automatically unloaded proportionately. In other words, a saving is made by the method of controlling the pressure.

This Lammert booster requires no foundation and is ideally adapted for portable use. It has forced-feed lubrication and is furnished with a separator that separates the oil from the gas very effectively.


Circle © High Speed Steel TOOLHOLDER BITS

are establishing unusual record on machining operations, not only by longer tool life, but by machining many materials considered unmachinable with other high speed steels. They have been adopted as standard equipment for shops where the management realizes that it pays to use only the best Toolholder Bits.

A few in your shop may come in mighty handy. Literature and price list sent on request.

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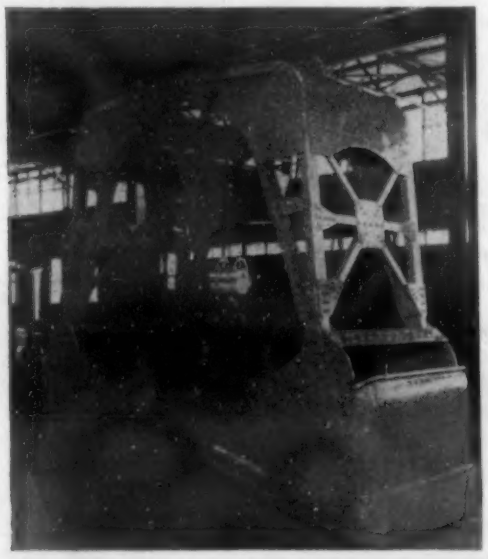
## New Type of Clam Shell Bucket

A new type of four-yard hook-on, two-line clam shell bucket, specially designed to meet the unusual crane conditions existing at most skull cracker pits of steel plants, has been perfected by the Blaw-Knox Co., of Pittsburgh, and has been in successful operation at the Pittsburgh works of the Jones & Laughlin Steel Corp. Since all single line, rope-reeved type buckets necessarily require certain automatic mechanisms, the new two-line bucket designed for hook-on operation eliminates many complexities and provides for greater versatility.

Owing to the fact that ladles and magnets as well as clam shell buckets must be handled at open-hearth cinder pits, the usual installation is a travelling crane with two hooks arranged in a plane at right angles to the tracks carrying the cars. This arrangement of hooks makes the use of the regular type two-line clam shell buckets impossible, since the buckets would have their jaws working in the wrong position for dumping broken slag into cars. As a result of this situation, most plants use single line hook on buckets, which have obvious disadvantages since they must handle broken slag ranging from fines up to large pieces extending to the full capacity of the jaw. In handling large skulls which do not permit complete closing of the bucket, the load cannot be dropped because of possible damage from sudden closing.



The new type bucket is picked up by both the main and auxiliary crane hooks. The one hook picks up a chain sling which is attached to the bucket head and the other hook picks up the operating line. With the two cable drums spaced at 3 or 4 ft., there is no fouling of the lines, and the bucket jaws are in the proper position in relation to the cars. The bucket is provided with an open top 5 ft. sq., so that the hook operating the dumping mechanism can have a short purchase on the cable reeved directly to the bucket. This makes it possible to operate the bucket with a head room of 24 ft., which would be impossible if the hook operating the bucket were attached above the bucket as is the practice in most two-line clam shells.

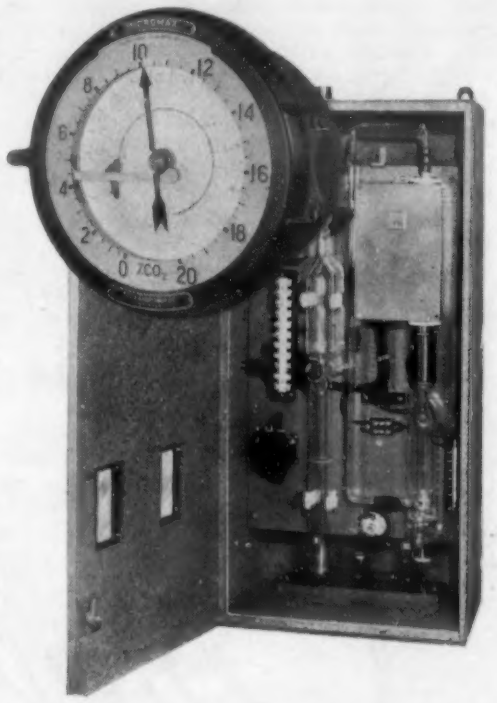
The bucket is of extremely sturdy construction, weighing 22,000 lbs. The jaws and trays are made of Cr-Ni-Mo steel, heat treated so that it is able to retain its properties in the presence of hot slag. This steel has a tensile strength of 100,000 lbs. per sq. in., and has a Brinell hardness at the cutting edges of 350. The scoop side plates are made of alloy steel of a tensile strength of 80,000 to 90,000 lbs. Hinge and corner castings are made of Ni-V steel with the main hinge pins of Cr-Ni heat-treated steel SAE 3140. Sealed anti-friction bearings are provided for all sheaves, and high tensile bronze bearings of 250 Brinell hardness are used for the hinges.

In spite of the fact that speed ratios on the two lines normally provided on the cranes often show wide variation, it has been found that even a difference in the ratio of five to one in the speed does not interfere with successful operation.

## Micromax $CO_2$ Recording Equipment

Using a much-simplified cell assembly which conditions a flue-gas sample by *saturating* rather than by drying it, an improved equipment announced by Leeds & Northrup offers steam plants high accuracy and quick response in continuous $CO_2$ recording . . . with low maintenance.

Overall performance is so improved over that of earlier, dry-gas models, that a far




larger number of engineers responsible for combustion efficiency will now find it both economical and satisfactory to measure $CO_2$ continuously by the inherently-sound, thermal-conductivity method . . . either to guide manual regulation, or to check the correctness of automatic control.

For details about this improved Micromax $CO_2$ recording equipment which uses the new, saturated-gas cell and operates on alternating current throughout, ask Leeds & Northrup, 4934 Stenton Ave., Philadelphia, for Catalog N-91-163.

## Weaver "Andarc" Welder

A new development in the field of arc welding has recently been introduced by James M. Weaver, of Monroe, Mich. This new electric arc welder, called the Weaver "Andarc" Welder, employs an entirely original electric circuit upon which complete patent rights have been secured.

Without the use of rectifying tubes, motor and generator, acids or chemicals, or, as a matter of fact, any hitherto known means of rectification, this equipment produces approximately 30% rectified current. For the first time a welder is offered to the industry that utilizes percentages of both alternating and direct current and obtains a result showing the successful combining of both.

The Weaver Welder, unlike the conventional transformer types on the market today, will use bare as readily as coated electrodes. Unlike many types in use, this equipment does not employ high frequency current, but operates on 60-cycle current.

Because of the workmanship and quality of materials put into this equipment, it has been shown that it is impossible to burn the welder out. Performance is not impaired even after the welder has been placed on a dead short for over 4 hrs.

The machine is controlled by a positive switch giving 28 different heats and a long and short arc. This fact gives it an elasticity that makes it ideal for all types of work. Especially good for intricate welding jobs in any plane, it has proved itself to be the answer to many welding problems. The national distribution of Weaver products is being handled by The E. & M. Sales Co., 3050 E. Grand Blvd., Detroit.

## Leco Sulphur Determinator

An extremely accurate and rapid metrod for determination of sulphur in metal, coal, coke, or any material which may be combusted in a stream of oxygen at elevated temperatures, has been announced by Laboratory Equipment Corp., St. Joseph, Mich. A sulphur determination within 5 mins. and with an approximate 0.0015 per cent plus-minus accuracy is claimed.

A combustion-titration method is used in which the sample to be tested is placed in a combustion furnace where it is burned off. The products of combustion are led through a special heating chamber and into a titration vessel containing measured amounts of hydrogen peroxide, a solution of sodium hydroxide and a special indicator. The sulphur gases unite with the hydrogen peroxide forming sulphuric acid, which in turn neutralizes part of the sodium hydroxide. Thereafter the operator titrates with a standardized sulphuric acid, and the amount of acid so used is measured in a special burette which gives the percentage of sulphur in the sample. The burette is calibrated for percentages from zero to 0.400. A change in weight of the sample will, however, give the operator a wider range.

In former applications of this method the operator was faced with certain difficulties which caused uncontrollable variations and error in the determination. During combustion, both $SO_2$ and $SO_3$ would form, the

$SO_3$ sometimes condensing in the tubing before reaching the titration vessel. Moisture would condense in the tubing and absorb part of the $SO_3$. The indicator used was effected by the chemicals and moreover had an uncertain and unreliable end point. It is claimed that these difficulties are completely overcome by the use of the "Leco Sulphur Determinator."

## A Vest Pocket Adding Machine

The "Arithmometer" adding machine is especially adapted for carrying in the vest pocket or ladies' hand bag; it is small in size, light in weight and accurate.

It is entirely constructed of cold rolled steel and nicely plated, and, with ordinary usage will last a lifetime. It is guaranteed for 5 yrs. It is built with the precision of a watch and weighs only a few ounces. A great time saver in shop, office, classroom, or home and indispensable to anyone having addition or subtraction to do. Aids, too, in multiplication and division.

All business firms have departments in which the amount of figuring does not warrant the purchase of a regular adding or calculating machine, and in these departments for checking incoming or outgoing bills, costs, inventory values, etc., the Arithmometer will quickly prove valuable. It is sold by the Tavella Sales Co., 25 West Broadway, New York.

## Fahrite Heat Saver Valve

Fahrite valves and dampers, produced by the Ohio Steel Foundry, Springfield, Ohio, form the easiest direct method for draft and temperature control of furnaces. A direct shut-off gate or damper made from an alloy requires no water cooling and permits a simplified and less costly control mechanism.

The damper or gate is an assembly of Fahrite heat-resisting alloy plates, tongued and grooved together and held in line by a single middle tie bar. Each section is free to expand independent of the other section. This eliminates warpage due to uneven heating since each plate expands in accordance with the heat applying to that section. Differential temperature occurs in dampers primarily when raised or partially raised. The lower sections are then much hotter than the upper sections. For this reason narrow sections are used at the bottom portion where maximum temperature variation occur.

The damper sections are made of Fahrite Grade N-3, which is a high heat-resisting alloy of chromium and nickel. It not only withstands oxidation up to 2000 deg. F. but also is unaffected by sulphur corrosion from waste gases. The alloy retains its high strength at elevated temperatures and does not warp or grow in service. It will not crack due to the thermal shock occurring in reversing.

The valve proper is machined along a pad surrounding its entire assembled surface. This machined surface slides along a seat having a full 4-in. surface machined for a complete bearing. The seat is made of Fahrite I-beams which are assembled in sections to permit free expansion for each member.

A more recent type of construction has been designed by the Freyn Engineering Co. With the direct motor control mounted on each hood, no cables are needed, connecting valves and all sheaves and supports are eliminated. This newer construction is in use by one of the most exacting producers of steel. Fahrite valves in this plant were installed to replace water-cooled valves, which operated less than a year.

A summary of the advantages of Fahrite dry dampers is briefly given as follows:

1. Fahrite dampers do not grow, warp or crack.
2. There is no deterioration in temperatures up to 2000 deg. which is far in excess of the safe operating temperature for cast iron.
3. No oxidation or corrosion such as occurs in cast iron and steel.
4. No chance of damper breaking and a portion dropping into the flue.
5. Fahrite dampers are much lighter and easier to operate than other types.
6. Heat saving in waste heat boilers installations.
7. Water cost saving.
8. Maintenance saving.
9. No failure due to muddy or acid containing water.
10. Ease of installation.
11. No water leaks into flues.
12. No accumulation or coking at seat due to cooling.

## "Duflex"—A Flexible Finish for Metal Products

A new flexible finish for high-grade metal products subjected to extremely hard usage, such as golf sticks and fishing rods, has been developed by Maas & Waldstein, makers of industrial finishes, Newark, N. J.

In gloss and wearing qualities, the new finish, which is known as "Duflex", closely resembles the finish produced by extruding or cementing celluloid upon a metal base, according to the manufacturer. The cost, however, is lower.

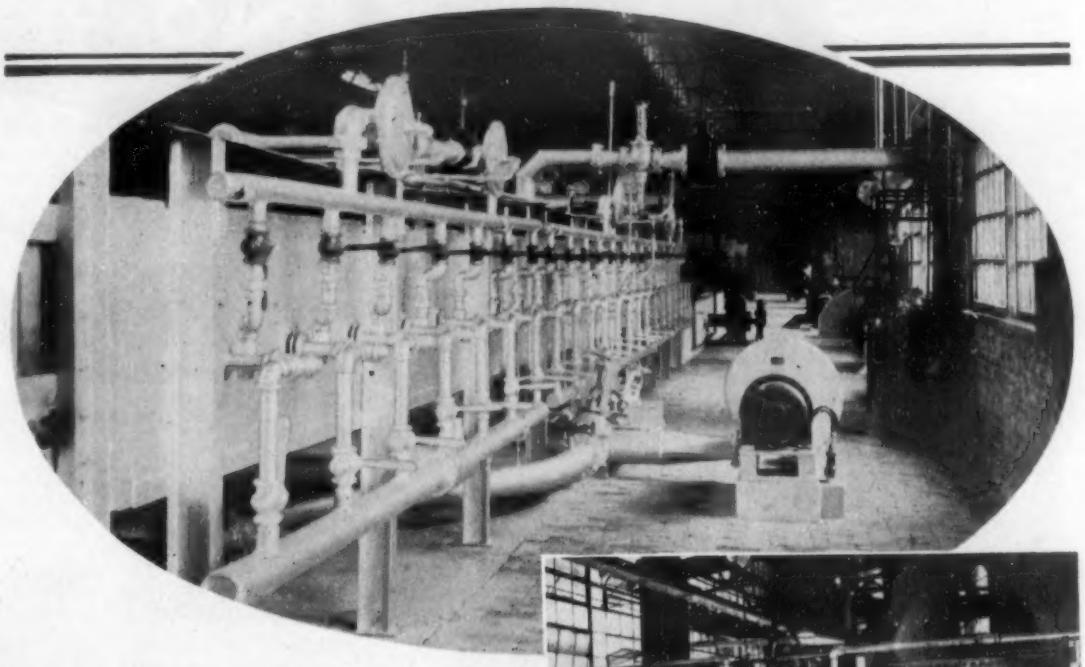
In finishing a product, such as the metal shaft for a golf club, by the Duflex process, the product is first covered with a primer coat of synpex enamel, which air-dries rapidly and does not require baking before graining. The grain is then applied in the usual manner, (if wanted) and both coats are baked. After baking, the product is given five dip-coats of clear Duflex lacquer. The resulting finish, the manufacturer states, has a deep gloss and is very flexible and durable. Any metal can be finished by this process.


# For Long-Life Efficiency and Economy

## SURFACE COMBUSTION COMPANY

## *Insulated these Modern Furnaces*

## with ARMSTRONG'S BRICK



ABOVE: *Armstrong's A-25 and N-16 Insulating Fire Brick help assure efficient operation of this wire patenting furnace built by the Surface Combustion Co.*

~ ~ ~

AT RIGHT: *Surface Combustion Co. also built this spring furnace, insulated for long-life, low-cost operation with Armstrong's N-20 Insulating Fire Brick.*

MODERN furnaces must perform with a degree of efficiency and economy in keeping with the high speed production of today's industrial plants. For this reason, the Surface Combustion Company —and many other leading furnace builders—assure maximum insulating efficiency for their equipment through the use of Armstrong's Insulating Fire Brick.

Because they are carefully manufactured from materials that possess natural insulating properties, Armstrong's Insulating Fire Brick assure low thermal conductivity. In addition, they possess high crushing strength and are exceptionally free from shrinkage. They are accurately sized to produce tight joints, easier laying, and more efficient construction. Use of these brick results in more uniform temperatures, lower fuel costs, and increased production.

Armstrong's light duty Insulating Fire Brick include N-16, N-20, and A-25 Brick for temperatures up to 1600°, 2000°, and 2500°F. Armstrong also manufactures heavy duty Insulating Fire Brick for more severe service. For samples and descriptive literature, write Armstrong Cork Products Company, Building Materials Division, 982 Concord Street, Lancaster, Pennsylvania.

# *Armstrong's*

## HIGH TEMPERATURE INSULATION

MA 325

ABO-COMPRE
DATA BOOK
No. 107

I. General Introduction
II. Characteristics and Advantages of Spencer Turbos
III. Applications:
1. Gas Burners
2. Oil Burners
3. Pneumatic Tube Systems
4. Foundry Cupolas
5. Gas Boosters
6. Agitation of Liquids
7. Pneumatic Conveying
8. Miscellaneous
IV. Sizes and Capacities
V. Tables, Formulas, etc
VI. Electrical Specifications

unusual applications but before any definite unit is
the details of the problem should be referred to th
ing department at Hartford for their considera
gestions. It is impossible to edit in any one
experience gleaned from over thirty-five
engineering.
with
ief

# THE NEW DATA BOOK ON COMPRESSED AIR

— A book of facts and figures on the movement of air in its various phases.

First time published.

A reference for all users of oil and gas-fired equipment, foundries, gas boosters, pneumatic conveyors and agitators.

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S-101

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MIDGET • SINGLE-STAGE • MULTI-STAGE
35 to 20,000 cu. ft. • ⅓ to 300 HP. • 8 oz. to 5 lbs.
THE SPENCER TURBINE COMPANY, HARTFORD, CONN.

# Manufacturers' Literature

### Pyrometers—Millivoltmeter Type

Catalog No. 15-C covers this company's complete line of the above—indicating, recording and controlling. The Brown Instrument Co., Philadelphia, Pa. (B 564)

### Electric Heating Units and Devices

Numerous small heating units for a multitude of tasks are listed in Bulletin GED-650 of the General Electric Co., Schenectady, N. Y. (B 565)

### Air Weight Control

The importance of air weight control, and the advantages of this company's controller, are given in a leaflet of The Foxboro Co., Foxboro, Mass. (B 566)

### Hardness Testing Machine

The four column, roller table direct reading Brinell machine is the subject of a leaflet from the Gogan Machine Corp., Cleveland, O. (B 567)

### Single-Stage Motorblowers

An illustrated catalog devoted to Type FS Motorblower lists many of the applications for which it is fitted. Ingersoll-Rand, New York, N. Y. (B 568)

### Gray Iron

New and useful facts about gray iron are offered in a booklet of that name by the Gray Iron Founders' Society, Inc., Cleveland, O. (B 569)

### Wire Mesh Baskets

For industrial use are illustrated and discussed in a booklet of Rolock, Inc., Southport, Conn. (B 570)

### Correct Burner Equipment

Bulletin SC-79 discusses savings which are possible by the use of the correct size and type of burner. Surface Combustion Corp., Toledo, O. (B 571)

### Enduro—18-8 Types

Tables of properties of Enduro and laboratory corrosion data are included in a profusely illustrated booklet. Republic Steel Corp., Massillon, O. (B 572)

### Hard Case

A breakdown test showing the Holden Hard Case to have uniformity, stability and practicability, is described. A. F. Holden Co., New Haven, Conn. (B 573)

### Calorized 1½% Moly

Circular 1 MOHT is devoted to the above for conveyor rolls and bolts and claims that it is as strong as 18-8. The Calorizing Co., Pittsburgh, Pa. (B 574)

### Industrial Ovens

Catalog No. 14 is a collection of bulletins dealing with the various types of ovens manufactured by the Despatch Oven Co., Minneapolis, Minn. (B 575)

### Ramming Mix

Instructions for installation are included in a folder claiming that P. B. Sillimanite ramming mix can be used under the most severe operating conditions. Chas. Taylor Sons Co., Cincinnati, O. (B 576)

### Simplified Optical Pyrometer

Catalog No. 70 states that the PYRO optical pyrometer is a rugged instrument, simple in operation and suitable for the requirements of scientific laboratories as well as for heavy duty shop practice. The Pyrometer Instrument Co., New York, N. Y. (B 577)

### Special Atmospheres for Industrial Furnaces

An instructive booklet explaining in detail the methods and composition required in designing and manufacturing inert gases. Continental Industrial Engineers, Inc., Chicago, Ill. (B 578)

### Duriron

Bulletin No. 150-D is devoted to the chemical and physical characteristics of Duriron, a high-silicon iron alloy containing approximately 14.5% silicon. The Duriron Co., Inc., Dayton, O. (B 579)

### Pyrometer Potentiometer

An improved potentiometer, unaffected by vibration is featured in a leaflet of The Lewis Engineering Co., Naugatuck, Conn. (B 580)

### Shear Knife Hand Book

This convenient hand book containing useful data was issued by Heppenstall Co., Pittsburgh, Pa. (B 581)

### Automatic Station Type Conveyor

Bulletin BD-30 contains a description of this hydraulic, rotary machine for handling large quantities of work through a sequence of baths eliminating dipping. The Bullard Co., Bridgeport, Conn. (B 582)

### Career in Arc Welding

Bulletin No. 416 tells of the practical and technical instruction given by the Lincoln Welding School. The Lincoln Electric Co., Cleveland, O. (B 583)

### Hold-Heet Pyrometers

Wall type and Lance type are described and illustrated in Bulletin No. 202. Russell Electric Co., Chicago, Ill. (B 584)

### Non-Cooled Furnace Valve

The Freyn-Fahrite valve for regulating and reversing service on open hearths, soaking pits and heating furnaces is described by the Freyn Engineering Co., Chicago, Ill. (B 585)

### Adjustable Orifice and Proportioning Valves

Leaflet describing and illustrating the above is offered by The North American Mfg. Co., Cleveland, O. (B 586)

### Modern Refractories for the Steel Industry

A reprint of this article by L. J. Trostel, Chief Chemist, is issued by the General Refractories Co., Baltimore, Md. (B 587)

### Stainless Steel

A table of comparative characteristics and applications of this company's stainless steels is included in a leaflet. Jessop Steel Co., Washington, Pa. (B 588)

### Graphitic Steel

This steel which, it is claimed, combines the more desirable features of cast iron with the high strength of steel, is the subject of a pamphlet of the Timken Steel and Tube Co., Canton, O. (B 589)

### Transformers

Bulletin No. 340 illustrates some recent installations of this company's equipment, showing the wide range of service of these transformers, in size and voltage. Pennsylvania Transformer Co., Pittsburgh, Pa. (B 590)

### Insulating Cement

Ada-Stic, a plastic insulating cement, is described in a leaflet which includes directions for mixing and applying. Botfield Refractories Co., Philadelphia, Pa. (B 591)

### Clean Gas Generator

The Wellman-Galusha Generator, a fully water-jacketed generator with rotary grates is claimed to assure gas of uniform quality and high heating value under widely fluctuating demand. The Wellman Engineering Co., Cleveland, O. (B 592)

### Rayotube—A Specialized Couple

Rayotube—standard for use with Micromax indicators—brings the full reliability of Micromax to controlled atmosphere furnaces. Its calibration is unaffected by contaminating gases. Leeds & Northrup Co., Philadelphia, Pa. (B 593)

### Refractory Specialties

High temperature cement (air setting), high temperature mortar (heat setting), plastic fire brick and insulating brick are some of the topics discussed in a leaflet of The Robinson Clay Product Co., Akron, O. (B 594)

### Hydraulic Welding Guns and Equipment

Constant pressure against the parts to be welded and the elimination of human element failures are advantages to be obtained by the use of this company's equipment according to a leaflet of the Progressive Welder Co., Detroit, Mich. (B 595)

### Ampco Metal

Engineering Data Sheet No. 39 is devoted to the subject of wear tests. Ampco Metal Inc., Milwaukee, Wis. (B 596)

### Celectray Pyrometers

Catalog No. 1101C describes how these pyrometers incorporate the phototube in various ways and claims greater sensitivity and accuracy for these controllers. C. J. Tagliabue Mfg. Co., Brooklyn, N. Y. (B 597)

### Cutting Tools

Physical characteristics, working data and recommendations for J-Metal are included in a profusely illustrated catalog of Haynes Stellite Co., New York, N. Y. (B 598)

# MANUFACTURERS' LITERATURE

### Brunorized Rails

The Brunorizing process for making better rails is described in an illustrated booklet containing data on laboratory and service tests. U. S. Steel Corp. Subsidiaries, Pittsburgh, Pa. (B 599)

### Dust Suppression Equipment

A report on dust-removal efficiency of Schneible multi-wash dust collector, by Hugh E. Keeler of the Univ. of Michigan, is offered in booklet form by the Claude B. Schneible Co., Chicago, Ill. (B 600)

### Magnetic Separation

Catalog No. 77 is concerned with the construction and application of the Type IR Super High Intensity Induction magnetic separator. Dings Magnetic Separator Co., Milwaukee, Wis. (B 601)

### Refractory Block Insulation

Insulblox, high temperature insulating refractory blocks for reducing heat storage and radiation losses at operating temperatures up to 2200 deg. F., is the subject of Bulletin No. 326 of the Quigley Co., Inc., New York, N. Y. (B 602)

### Flexarc Welder

Flexarc motor driven welders and bare generators are described in a leaflet from the Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa. (B 603)

### Testing Springs

Four types of apparatus for testing springs—"Elasticometers"—are described in an illustrated leaflet. The Coats Machine Tool Co., Inc., New York, N. Y. (B 604)

### Purifying Molten Iron

An iron finishing compound used in the pouring ladle for improving the castings is described in a pamphlet of The Malumінum Co., Indianapolis, Ind. (B 605)

### Berwick Electric Metal Heaters

Among the advantages claimed for electrically heating steel are: there are no impurities in electricity to affect the steel and the only loss is by radiation. American Car and Foundry Co., New York, N. Y. (B 606)

### TAM Products

Leaflet descriptive of TAM metallurgical alloys. The Titanium Alloy Mfg. Co., Niagara Falls, N. Y. (B 607)

### Brazing Alloys

The results of both laboratory and actual production data are contained in Bulletin No. 1. Handy & Harman, New York, N. Y. (B 608)

### Mo-Max High Speed Steels

Composition, tool performance, heat treatment, operations and difficulties are discussed in a booklet devoted to Mo-Max. The Cleveland Twist Drill Co., Cleveland, O. (B 609)

### Stainless and Heat Resisting Electrodes

Price list and data book containing descriptions of the company's products and analyses of stainless and heat resisting alloys manufactured by other companies. Maurath, Inc., Cleveland, O. (B 610)

### Herculoy

Bulletin containing data on this silicon bronze alloy which, according to the manufacturer, possesses the strength of steel and corrosion resistance of copper. Revere Copper and Brass, Inc., New York, N. Y. (B 611)

### Sonittep Products

This booklet discusses heat loss, its control, the advantages of Sonittep insulating cement and its uses. George F. Pettinos, Inc., Philadelphia, Pa. (B 612)

### Extensometer

The Kenyon-Burns Young extensometer is described and illustrated in Bulletin 128. Baldwin-Southwark Corp., Philadelphia, Pa. (B 613)

### Salt Bath Furnace

The Ajax-Hultgren electrically heated salt bath was designed to meet the metallurgical requirements of liquid heat treating operations. Bulletin 103. Ajax Electric Co., Inc., Philadelphia, Pa. (B 614)

### Fire Clay Products

A folder contains brief descriptions of the Goose Lake Products and Therm-O-Flake (for high temperature insulation) products. Illinois Clay Products Co., Joliet, Ill. (B 615)

### Sand Control in the Foundry

A colorful pamphlet lists the major causes of casting defects and inferiorities and states that they may be avoided by the use of the proper sand control equipment. Illustrated. Harry W. Dietert Co., Detroit, Mich. (B 616)

### Zinc Alloy Die Castings

This supplement of "A Visual Report of Progress" brings the progress being made in the die casting industry up to date. The New Jersey Zinc Co., New York, N. Y. (B 617)

### Magnaflux

This system of inspection is described in a colorful folder, illustrating four typical magnetizing units used in this process. Magnaflux Corp., New York, N. Y. (B 618)

### Control System

Bulletin No. 460T describes a coordinated control system for automatically operating all the technical operations and factors of an industrial process. The Bristol Co., Waterbury, Conn. (B 619)

### MoTung High Speed Steel

An illustrated booklet contains information on working and treatment, surface protection, high heat temperatures, etc. Universal-Cyclops Steel Corp., Bridgeville, Pa., and Titusville, Pa. (B 620)

### Nickel Silver

Booklet describing this product as manufactured in sheets, strip, wire and rods, and profusely illustrated with the industrial applications of the product. The Riverside Metal Co., Burlington County, Riverside, N. J. (B 621)

### Magnet Steel

"Nipermag"—a permanent magnet alloy—is the subject of an illustrated booklet. Cinaudagraph Corp., Stamford, Conn. (B 622)

### Zinc Plating

Zin-O-Lyte, a process for bright zinc plating producing brilliant deposits direct from the bath without bright dipping, is the subject of a new bulletin of the Grasselli Chemicals Dept. of E. I. du Pont de Nemours & Co., Cleveland, O. (B 623)

### Industrial Products

The 1936 edition of this catalog contains information and recommendations on high and low temperature insulations for every industrial need. Illustrated. Johns-Manville, New York, N. Y. (B 624)

### Flame Hardening

New method of surface hardening which heats the metal with oxyacetylene, almost simultaneously quenching it with water is described by the Air Reduction Sales Co., New York, N. Y. (B 625)

### What Scientists Says of Leitz Ultropak

Bulletin No. 17 describes the personal experiences and applications to which Ultropak has been placed by scientific workers in various fields. E. Leitz, Inc., New York, N. Y. (B 626)

### Gasifier

A pamphlet on the Stewart gasifier claims that its use reduces fuel costs as much as 75%, produces a true gas of high B.t.u. value and is easier on furnace lining. Chicago Flexible Shaft Co., Chicago, Ill. (B 627)

### Positive Displacement Blowers

Bulletin 22-B12 discusses the structural features of these blowers. Roots-Connersville Blower Corp., Connersville, Ind. (B 628)

### Checker Brick for Regenerative Furnaces

When laid, the "Superior" checker bricks are automatically locked in place producing a stable checker volume and straight flues. Wm. M. Bailey Co., Pittsburgh, Pa. (B 629)

### Industrial Air Cleaning

Bulletin No. 904 discusses the use of electrostatic precipitators for air cleaning. The Pangborn Corp., Hagerstown, Md. (B 630)

### Fluxing, Deoxidizing and Hardening Alloys

Ajax alloys are the subjects of a new leaflet issued by the Ajax Metal Co., Philadelphia, Pa. (B 631)

### Surface Hardening by Induction

The TOCCO Process is discussed in an illustrated leaflet of The Ohio Crankshaft Co., Cleveland, O. (B 632)

### Chapmanizing

A pamphlet devoted to Chapmanizing which is a process of hardening low-carbon steel, compares it to nitriding and carburizing. The Chapman Valve Mfg. Co., Indian Orchard, Mass. (B 633)

### Manganese Steel Products

Bulletin R-1 which states that this company's rolled manganese steel follows precisely the "Hadfield Formula" also contains list of applications. Manganese Steel Forge Co., Philadelphia, Pa. (B 634)

# MANUFACTURERS' LITERATURE

### Air Conditioning Lectrodryer

This equipment is designed for dehumidification and not for temperature control. Pittsburgh Lectrodryer Corp., Pittsburgh, Pa. (B 694)

### Electromet Review

This publication, whose purpose is to bring "News and Views of Alloy Steels and Irons" to the reader, contains interesting items. Electro Metallurgical Co., New York, N. Y. (B 695)

### Research Microscopes

Microscopes and their accessories are discussed in Catalog M66. Spencer Lens Co., Buffalo, N. Y. (B 696)

### Portable Tensile Tester

The manufacturer claims that this tester is a real time and money saver and specimens may be tested accurately even by the inexperienced. Detroit Testing Machine Co., Detroit, Mich. (B 697)

### Control of Furnace Atmosphere

Two bulletins devoted to a description of Certain Curtain Control of Atmosphere"; and to furnaces for pre-heating and hardening high-speed steel have been issued by C. I. Hayes, Inc., Providence, R. I. (B 698)

### Improved Pot Hardening Furnaces

A leaflet devoted to these furnaces has been issued by the American Gas Furnace Co., Elizabeth, N. J. (B 699)

### Carbon Determinator

Construction and operation of the Leco Carbon Determinator are explained in an illustrated booklet. Laboratory Equipment Corp., St. Joseph, Mich. (B 700)

### Alloy Steels

A colorful folder devoted to these steels lists some of the advantages to be obtained by their use. Bliss & Laughlin, Inc., Harvey, Ill. (B 701)

### Current Input Controller

Bulletin G-12 describes this controller developed to give close regulation to electrically heated furnaces, ovens, etc. Automatic Temperature Control Co., Philadelphia, Pa. (B 702)

### Speed Case Steels

Data on the three new types of this company's "Speed Case" steel in the higher carbon ranges are offered by The Monarch Steel Co., Indianapolis, Ind. (B 703)

### Superficial Hardness Tester

Catalog Supplement RS-3 is devoted to this hardness tester, intended for tests where only very shallow penetration is possible. Wilson Mechanical Instrument Co., New York, N. Y. (B 704)

### Optical Pyrometer

The Burrell optical pyrometer, a direct reading instrument, is described in a leaflet published by the Burrell Technical Supply Co., Pittsburgh, Pa. (B 705)

### Vapor-Spray-Vapor Detrex Degreaser

This special machine equipped with a monorail conveyor is described in literature from the Detroit Rex Products Co., Detroit, Mich. (B 706)

### Stainless Steel Castings

An attractive booklet contains useful information on the subject. Typical analyses, characteristics and suggested uses are listed. Joseph T. Ryerson & Son, Inc., Chicago, Ill. (B 707)

### Ring Type Proving Instruments

These instruments for checking materials testing machines are pictured in a leaflet which states that they are made in eleven capacities—compression only and compression and tension both. Morehouse Machine Co., York, Pa. (B 708)

### Armco H.T.-50

An illustrated folder devoted to the above alloy steel contains data on the average physical properties, corrosion resistance and forming and welding qualities. American Rolling Mill Co., Middletown, O. (B 709)

### Turbo-Compressor Data Book

This Data Book No. 107 was prepared to give accurate and brief information on the engineering characteristics of turbo blowers and exhausters. The Spencer Turbine Co., Hartford, Conn. (B 710)

### Konik

Data on this steel's physical properties, corrosion resistance and working are offered by the Continental Steel Corp., Kokomo, Ind. (B 711)

### Quenching Machine

In the Greene tank objects are forced apart and kept in motion, solution vigorously sweeps over the objects and cooling is equal on all sides according to a leaflet of E. G. Greene, Cleveland, O. (B 712)

### Modern Metal Finishing

This bulletin, issued periodically, conducts a Questions and Answers department for metal treaters. E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. (B 713)

### 3300 Deg. Super Refractory

An illustrated catalog devoted to "Shamva" Mullite contains information regarding its background, characteristics and uses. Mullite Refractories Co., Shelton, Conn. (B 714)

### Lead

New methods for making lead pipe and lead sheet are announced by The Andrews Lead Co., Inc., Long Island City, N. Y. (B 715)

### Hi-Steel

Information concerning chemical composition, physical properties and corrosion resistance of this steel is offered by the Inland Steel Company, Chicago, Ill. (B 716)

### Dowmetal Data Book

A new edition, containing especially significant accomplishments in the sections Available Forms and Shop Practice has been published by The Dow Chemical Co., Midland, Mich. (B 717)

### Steel Castings

A number of the more popular carbon, alloy and stainless steels made by this company are discussed in a leaflet. Lebanon Steel Foundry, Lebanon, Pa. (B 718)

### Monel Metal

Many of the industrial uses of this alloy are discussed in a catalog entitled "Strength Plus—Monel for Mechanical Jobs." The International Nickel Co., Inc., New York, N. Y. (B 719)

### Fire Brick

This company's Empire fire brick is the subject of a booklet in which the three types—dry press, stiff mud and hand-made—are described. A. P. Green Fire Brick Co., Mexico, Mo. (B 720)

### Gas Analysis

Bulletin describing the thermal conductivity method of gas analysis is published by Charles Engelhard, Inc., Newark, N. J. (B 721)

### High Temperature Insulation

For all types of heated equipment is the subject of an illustrated leaflet issued by Armstrong Cork Products Co., Lancaster, Pa. (B 722)

### Duraloy

Chrome-nickel and chrome-iron alloy groups with recommended applications are listed in a pamphlet from Duraloy Company, Pittsburgh, Pa. (B 723)

### The Metal Analyst

Equipment for metallurgical laboratories is described and illustrated in a booklet of Adolph I. Buehler, Chicago, Ill. (B 724)

### Controlled Grain Anodes

Seymour Nickel Anodes are homogeneous in grain structure, according to this bulletin. Available shapes are illustrated and useful data are given. The Seymour Manufacturing Co., Seymour, Conn. (B 725)

### Metal Working Products

A pamphlet containing information on this company's rust preventives, cutting oils, metal cleaners, liquid baths, quenching oils, etc., has been issued by E. F. Houghton & Co., Philadelphia, Pa. (B 726)

### Gas Fired Furnace

The manufacturer of the gas fired Lindberg Cyclone furnace for heating at temperatures from 250 deg. F. to 1400 deg. F. claims that the heating rate is remarkably fast. Lindberg Engineering Co., Chicago, Ill. (B 727)

### Drop Forging Topics

Interesting articles are included in this illustrated publication of the Drop Forging Association, Cleveland, O. (B 728)

### Special Atmosphere in the Heat Treatment and Brazing of Metals

A reprint of the above article by C. L. West, Research Engineer, is offered by The Electric Furnace Co., Salem, O. (B 729)

### Free Cutting Steel

An attractive booklet records fifteen years research on the machinability of free cutting steels. Jones & Laughlin Steel Corp., Pittsburgh, Pa. (B 730)

### Meehanite Metal

A specification chart of recommended grades for various service requirements has been issued by the Meehanite Metal Corp., Pittsburgh, Pa. (B 731)

# Advertisers' Index


*Air Reduction Sales Company* ..... MA 275
*Ajax Electric Company, Inc.* ..... Outside Back Cover
*Ajax Electric Furnace Corp.* ..... Outside Back Cover
*Ajax Metal Company* ..... Outside Back Cover
*Ajax Electrothermic Corporation* . Outside Back Cover
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